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The effects of video- and book-comic instruction on learning attainments in science classrooms in Namibia

by
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DECLARATION

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ABSTRACT

This study aimed to assess the effectiveness of incorporating book- and video-mode comics as instructional materials within a resource-constrained English Second Language (ESL) primary science classroom. Additionally, it sought to explain the experiences and challenges faced by teachers when utilising book- and video-based comic instruction. The study employed a concurrent nested design, constituting a mixed-method research approach. In the quantitative component of the research, a true experimental design was adopted, involving the administration of pre-tests and post-tests to both a control group and two experimental groups from each of the participating schools. The study was conducted across four schools in the Omusati region of Namibia, encompassing a total of nine teachers and 178 Grade 4 students. Quantitative analysis of the data was carried out using Mixed Model ANOVA Type III. The findings of the study indicate a statistically significant difference in Grade 4 Science learning outcomes among students exposed to video-mode and book-mode comic instruction when compared to those taught through traditional methods. Furthermore, the study revealed that there is no statistically significant difference between the two comic modes, even though the mean score for the video-mode comic group was higher than that of the book-mode comic group. In the qualitative segment of this research, an in-depth interview approach was employed. Data gathered from interviews were subjected to analysis using the inductive content analysis method. The outcomes of this qualitative analysis shed light on the experiences of teachers with regard to the use of comics, as well as the challenges encountered by both teachers and students in the teaching and learning process.

Keywords: efficacy, video-mode comics, book-mode comics, teaching instruction

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DEDICATIONS

I doth dedicate this thesis to the noble Kingdom of Embodi.

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ACRONYMS

ANOVA:	Analysis of Variance
AS:	Advanced Subsidiary Level
CVR:	Content Validity Ratio
ESL:	English Second Language
IGSCE:	International General Certificate of Secondary Education
MBESC:	Ministry of Basic Education, Sport and Culture
MOI:	Medium of Instruction
NIED:	National Institute for Educational Development
NSHE:	Natural Sciences and Health Education
NSSCO:	Namibian Senior Secondary Certificate Ordinary Level
PEHRC:	Privatisation in Education and Human Rights Consortium
SEO:	Senior Education Officer
SLT:	Social Learning Theory
SPSS:	Social Sciences Statistical Package
STAD:	Students Teams-Achievement Model
STEAM:	Science, Technology, Engineering, Arts and Mathematics
STEM:	Science, Technology, Engineering and Mathematics
TV:	Television
UBPS:	Urban-based Primary School
UNIN:	United Nations Institute for Namibia

CHAPTER 1

General background and orientation

1.1 Introduction

This study investigates the impact of comic instruction within a resource-constraint ESL Grade 4 Science classroom in Namibia. It sheds light on teachers' experiences with this instructional approach and their challenges while implementing it. Additionally, this research explores the strategies teachers employ to address the obstacles faced by educators and students during the teaching and learning process with comics.

In this chapter, I introduce the study by providing a background context, elucidating the research problem, and outlining the research questions. Furthermore, I specify the study's focus, delineate the research objectives, and underscore the significance of the research. Additionally, this chapter provides an overview of the study's structure and furnishes operational definitions for the key terms employed in this research.

1.2 Background

Before achieving independence, Namibia was subjected to colonisation, initially by Germany and later by the South African apartheid government following World War I. The educational landscape in Namibia during this period was heavily influenced by the policies these two colonial powers mandated. In the pre-colonial and early German colonial eras, Namibia's educational system was predominantly informal, with only a few children attending church schools (Bauer, 2022). The introduction of formal schooling in Namibia coincided with South African governance.

On January 1, 1954, the Bantu Education Act was enacted into South African law, passed in 1953 by the government of that time. Given Namibia's status as a province of South Africa at the time, this legislation was incorporated into the educational framework of Namibia. It is essential to emphasise that during this period, the South African government administered education with

officially sanctioned racial segregation and discrimination against black individuals, both in South Africa and, by extension, in Namibia (Bauer, 2022).

Despite the inception of formal education in Namibia following World War I, the South African colonial regime only succeeded in extending educational access to non-white individuals in the late 1960s. It is imperative to highlight that although formal education enrolment was broadened, distinct educational systems were implemented, each delineated along racial lines (Von Back & Nuppenau, 2022). The differentiation of educational systems was explicitly delineated within the framework of the Bantu Education Act.

For instance, certain school subjects were not accessible to the country's entire populace. The Education Act of the South African apartheid government specifically promoted the provision of science education to the predominantly white population, denying black Namibians the opportunity to pursue science subjects. Instead, they were directed toward vocational training, primarily contributing to semi-skilled and unskilled labour sectors (Tjikua, 2000).

As the window of opportunity for change and freedom was about to open in 1989, numerous potential educational changes and dreams emerged during the international conference at the United Nations Institute for Namibia (UNIN). At this conference, Science was prioritised for the entire Namibian population. Using a student.t-centred approach as a teaching method was envisioned and advocated for every classroom in Namibia. According to Tjikua (2000), this conference also marked a pivotal juncture in selecting English as the medium of instruction for junior secondary education, with a concurrent forecast that mother tongue languages would be employed as the medium of instruction in primary education. At that time, primary education encompassed Grades 1 to 7, junior secondary covered Grades 8 to 10, and senior secondary spanned Grades 11 to 12. Notably, Namibian students were being taught in Afrikaans as the medium of instruction across the curriculum. The resolutions of the conference highlighted the necessity for comprehensive reforms to rectify the injustices of the past.

However, despite the resolutions from the UNIN conference, Namibia continued to grapple with the remnants of the discriminatory education system inherited from the apartheid era when it attained independence in 1990 (Von Back & Nuppenau, 2022). These remnants imply that the envisioned reforms outlined in the UNIN conference resolutions were not realised upon independence.

The Namibian Ministry of Education established a language policy in 1992 that did not explicitly require schools to use a mother tongue as the medium of instruction in primary education, as initially envisioned at the United Nations Education Conference. This lack of clarity in the policy allowed many Namibian schools offering Grade 1 to opt for English as the medium of instruction and neglect local languages, as noted by Chavez (2016). However, the Ministry of Basic Education, Sport, and Culture (MBESC) (2003) emphasised the importance of educating lower primary students in their mother tongue to enhance concept formation, literacy, and numeracy skills. Consequently, there was a need to revise the language policy for Namibian schools to promote the use of students' mother tongues as the medium of instruction in Grades 1 to 3, thereby preserving language and cultural identities (MBESC, 2003).

To align with the aspirations of the Namibian people and rectify the injustices imposed by the apartheid government, the newly established government initiated educational reforms in 1996. As part of these reforms, the government adopted the Cambridge system, which oversaw the administration of the International General Certificate of Secondary Education (IGCSE) and Higher International General Certificate of Secondary Education (HIGCSE), as noted by Von Back and Nuppenau (2022). Despite implementing the new language policy within this system, challenges persisted, particularly in academic performance. English as the medium of instruction in the Cambridge system posed difficulties, given that, for most of the Namibian population, English was their third or fourth language. This language barrier also adversely affected the teaching of Science subjects, as highlighted by Tjikua (2000). As per the findings of Tjikua (2000), other challenges prevalent at that time included the unavailability of new materials and textbooks tailored to the Namibian context in the new educational system. Additionally, challenges included limited

parental involvement, overcrowded classrooms, and a high dropout rate due to teachers' and students' lack of commitment.

Faust (2016) recounted the new government's commitment to embracing the people's right to education in response to prevalent educational challenges such as parental ignorance, school dropouts, and overcrowded classrooms. Notable improvements were observed around 2000 when primary education enrolment significantly increased from 60% to 95% (Faust, 2016). This period also witnessed a substantial expansion in teacher recruitment, with a 30% increase and the construction of 3,000 new classrooms across the country (Faust, 2016). These investments in education were considered essential for transforming Namibian citizens' lives, offering employment prospects, increased income, improved health, poverty reduction, and overall life fulfilment for individuals (Von Back & Nuppenau, 2022).

To expedite the favourable outcomes of this educational transformation, the government enacted the Education Act 16 of 2001. This legislation stipulated that primary and secondary education should be offered without fees and included performance standards to be implemented as students advanced through various grade levels, as Faust (2016) outlined.

Despite the comprehensive educational reforms aimed at enhancing access, equity, quality, and democracy, effectively implementing these initiatives remained challenging, as the Privatisation in Education and Human Rights Consortium (PEHRC) (2022) noted. In theory, teachers were expected to adopt student-centred pedagogy and position themselves as creative facilitators within the classroom, which were considered crucial for educational change. Student-centred was the vision following Namibia's adoption of the Cambridge Education system in 1996 and the formulation of educational standards outlined in the Education Act 16 of 2001. However, studies conducted between 2007 and 2018 revealed that the full realisation of the student-centred approach in Namibian classrooms had yet to be achieved. Traditional lecture-based methods and similar approaches remained prevalent, as indicated by research conducted by Awe (2007), Amakali (2017), and Haimbangu (2018).

In 2007, Namibia made the significant transition from the (H)IGCSE (International General Certificate of Secondary Education) to the Namibian Senior Secondary Certificate Ordinary/Higher (NSSCO/H) examination system as part of efforts to localise the examination framework. This transition aimed to align the examination content with the experiences and knowledge of Namibian students, potentially leading to improved academic performance (Maletsky, 2007). The decision for this change was prompted by the fact that in 2006, out of 14,319 Grade 12 students who took the (H)IGCSE examination, only 3,393 qualified for admission to local and foreign universities (Maletsky, 2007). While this performance was considered the best since the introduction of (H)IGCSE in Namibian schools, it was still viewed as underperformance after fifteen years of its implementation. This performance emphasised the ongoing challenges in Namibian education, particularly in learning outcomes, access, and retention. The persistence of issues such as inadequate classroom infrastructure, teacher commitment, poor student academic performance, and retention rates remained areas of concern that needed to be addressed (PEHRC, 2022).

Therefore, in 2015, a comprehensive revision of the national curriculum for Basic Education was undertaken to tackle pressing issues in the education system, including concerns related to student academic performance and retention up to the senior secondary level. The revised curriculum restructured primary education into five distinct phases: Pre-Primary, Junior Primary (Grades 1-3), Senior Primary (Grades 4-7), Junior Secondary (Grades 8-9), and Senior Secondary (Grades 10-12). The Senior Secondary level comprises two distinct courses: Ordinary Level (NSSCO), encompassing Grades 10 through 11, and Advanced Subsidiary (AS), corresponding to Grade 12. This new change means the Senior Secondary phase replaced the NSSCO/H levels with the NSSCO/AS levels. The Advanced Subsidiary is a one-year program following the Grade 11 external examination, exclusively available to students who have achieved a minimum of three C symbols in the Grade 11 external examination. Grade 12 is not mandatory; students who have completed Grade 11 can pursue vocational training or specific degree programs at universities rather than progressing to Grade 12. Consequently, the Pre-Primary and Junior Primary phases

established the foundational skills necessary for advanced learning up to Grade 12 (Ministry of Education, Arts and Culture, 2016).

Furthermore, the revised curriculum strongly emphasised teaching Science through a subject called Natural Science and Health Education in Grade 4, serving as an entry point to the Senior Primary phase. Teaching natural sciences aims to enhance scientific literacy, enabling students to grasp scientific processes and apply scientific thinking and skills (National Institute for Educational Development (NIED), 2016). Additionally, the revised curriculum highlighted the importance of teaching Arts subjects, including Natural Science and Health Education, to Grade 4 students. This emphasis on the arts contributes to the foundation of a knowledge-based society by fostering creativity, communication skills, and innovation among students. In conjunction with the curriculum changes, a language policy was formulated to guide schools regarding the language of instruction used from pre-primary to Grade 12.

In Grades 1-3, students were instructed in their mother tongue or the dominant local language in the school's vicinity. The transition to using English as the medium of instruction took place in Grade 4. Additionally, the language policy stressed that schools or parents wishing to adopt English as the medium of instruction could request the Ministry of Education if they offered a well-founded and persuasive rationale (Ministry of Education, Arts and Culture, 2016). Therefore, the policy did not eliminate the possibility of using English as the medium of instruction from pre-primary or Grade 1, provided there was a valid reason to do so.

The choice of the medium of instruction has led some schools, particularly those in urban areas with students from diverse linguistic backgrounds, to opt for English as the medium of instruction. This decision is made possible through the Minister of Education's approval (Ministry of Education, Arts and Culture, 2016). However, thousands of schools in rural areas have no alternative but to provide instruction in the mother tongue from Grades 1 to 3. This situation is because rural schools predominantly serve students from the same linguistic background, making it challenging to justify a shift to English as the medium of instruction to the Ministry of Education, except in cases where the school serves students from diverse linguistic backgrounds. While the Ministry of Education

views teaching Grades 1 to 3 in the local language as advantageous for students, many teachers have voiced concerns about the language barrier when teaching science concepts in Grade 4, where English becomes the medium of instruction.

For instance, a study conducted in South Africa by Avans and Nthulana (2018) highlights teachers' concerns about students taught in Tshivenda as the medium of instruction from Grades 1 to 3. These students encountered difficulties when transitioning to English as the medium of instruction in Grade 4. This situation prompted more schools to seek permission to use English as the medium of instruction from pre-primary to Grade 3. However, the Ministry only permits urban schools to do so, leaving students in rural areas to grapple with the challenge of adjusting to learning English in Grade 4, a language in which they still need to be proficient. The language barrier issue could significantly impact students' academic performance in specific grades and subjects than others.

Grade 4 is a pivotal year in students' education as it marks their introduction to English as the medium of instruction for the first time. In addition to this linguistic shift, students transition from class teaching to subject-based teaching and must take examinations. This transition from the Junior Primary phase to Grade 4 can significantly impact their academic performance, especially in subjects like Science, which often presents abstract concepts unfamiliar to students in their home environments. This concern has been raised by Evans and Nthulana (2018), who note that teachers, particularly in rural monolingual communities, frequently report challenges related to students' adjustment to Grade 4. These unique challenges set Grade 4 apart from other grades in the curriculum.

Evans and Nthulana (2018) emphasise that Grade 4 students not only grapple with new cognitive demands but also face the daunting shift from three years of instruction in their mother tongue to English. This transition can exert additional pressure on students as they strive to meet the academic demands of Grade 4, which may differ significantly from previous grades. In light of these challenges, Boateng (2019) suggests that the transition to English as the instruction medium should occur later rather than in Grade 4. The study also expresses concerns that an abrupt transition at an early stage, such as Grade 4, may lead to lower learning attainment due to

insufficient cognitive development, linguistic skills, and academic preparation in their mother tongues before the language switch. Given these challenges associated with the sudden change in the medium of instruction in Grade 4, teaching Science in such an environment can be particularly challenging.

Teaching difficulties often arise due to the abstract nature of scientific concepts. Science is fundamentally about understanding the natural world through systematic observation, experimentation, and formulating theories and models to explain phenomena (Chi et al., 1994). These theories and models are abstract representations of the natural world scientists construct to make sense of empirical data. This analogy is supported by Evagorou et al. (2015), who said that utilising visual depictions, including photographs, diagrams, and models, has been an integral component of the scientific field. Their incorporation enables scientists to engage with and portray intricate phenomena that are otherwise unobservable.

Therefore, at its core, Science involves abstract ideas and concepts. Learning and comprehending scientific concepts involve cognitive processes within a student's mind. Students engage in activities like observation, hypothesis formation, experimentation, and theory-building, all of which are cognitive processes. These processes are not tangible; they occur within the mental realm, making Science a subject that primarily exists as abstract ideas and mental constructs (Evagorou et al., 2015). Teaching and learning science often revolves around imparting and internalising these abstract scientific concepts in educational contexts. Students are exposed to these concepts through teachers, textbooks, experiments, and discussions. Their understanding of Science is based on how well they can grasp and apply these abstract ideas through conceptual change (Chi et al., 1994).

According to Chi et al. (1994), conceptual change is when we rethink or reassign a concept from one category to another. For instance, in Science, this might happen when we realise that something we thought of as a thing (like an object) behaves more like a process or interaction. Some shifts in our thinking are more complex than others. This difficulty is linked to whether our original idea and the new scientific concept belong to the same category. If they do, it is easier to

change our thinking. However, if they belong to different categories, it is more challenging. For example, imagine we initially thought of light as a physical thing (like a particle), but Science tells us it is more like an interaction or process. That shift is more complex because our old and new ideas belong to different categories (Section 5.2).

So, when we learn abstract scientific concepts, our brain uses existing abilities, like recognising objects, to help us understand new things. It is like our brain recycles its functions for Science. Studies have shown that when people think about physics concepts, different parts of their brains light up, and these brain regions are connected to basic skills like seeing motion or sensing things in our environment (Hayes & Kraemer, 2017). For instance, brain parts that deal with seeing motion get active when thinking about how things move (like gravity or torque). Brain parts related to music and rhythms also get active when thinking about things with a pattern (like waves or frequencies). This analogy suggests that our brain uses its sensory and movement abilities to make sense of scientific concepts. These abilities come from different parts of the brain, and a system in our brain puts all these pieces together to help us understand complex scientific ideas (Hayes & Kraemer, 2017).

Hence, the inherently abstract nature of Science renders it particularly susceptible to the challenges posed by transitioning from the mother tongue medium of instruction to English, as the language barrier may significantly influence the process of conceptual change. This viewpoint is corroborated by Hazali (2012), who emphasises that despite English Second Language (ESL) students performing well in mathematics and other subjects, many still encounter challenges when comprehending abstract scientific concepts and scientific content. This difficulty may be attributed to reading comprehension being a fundamental skill for elementary school students to learn Science effectively (Meneses et al., 2018). Moreover, Williams et al. (2018) argue that there exist various forms of written discourse employed in conveying scientific knowledge within the Science, Technology, Engineering, Arts, and Mathematics (STEAM) disciplines, which students must be able to unpack and fully grasp in order to comprehend the intricacies of scientific principles and excel in these subjects.

Therefore, developing more effective teaching strategies to improve and strengthen reading and listening comprehension of science concepts in a Grade 4 Science classroom and prepare students to excel in the STEAM fields would be necessary. When considering STEAM while considering new teaching and learning strategies, the traditional way of teaching, mainly using text materials, needs to be re-evaluated. For example, a review of primary Science text materials for ESL students in developing countries conducted by Peacock (2010) has shown that children in primary schools find their texts the most difficult to understand. Peacock (2010) further states that for students' academic performance to improve, more studies need to be conducted on how texts for elementary schools are published, generated, and adopted by schools.

For example, a Grade 4 Science subject in the Omusati Region in Northern Namibia performs below average in the regional examination. The poor performance is the case because in 2018, 2019, 2020, and 2021, less than half of the students doing a Science subject scored between A and D, which are Grades referring to 80-100% and 50-59%, respectively (Omusati Regional Advisory Services, 2018; Omusati Regional Advisory Services, 2019; Omusati Regional Advisory Services, 2020; Omusati Regional Advisory Services, 2021).

Hence, the subpar performance in Science and the transitional challenges faced by Grade 4 students prompted me to employ various comic instructions as teaching tools. This approach aims to enhance the comprehension of science concepts among Grade 4 students while maintaining the existing language policy with its stated objectives intact. The teaching methods employed in Omusati regional schools primarily revolve around a teacher-centred approach characterised by expository instruction. In this expository method, students acquire scientific facts, theories, and their interconnections through direct guidance provided by the teacher. According to van Borkulo et al. (2012), the expository instructional approach conveys information directly to students through text-based materials. Support is offered through assignments but lacks interactive elements like simulations or concept maps.

In the context of comic instruction, Lee and Kim (2015) highlight the positive impact of educational comics on enhancing students' learning competencies. This assertion is reinforced by Marianthi et

al. (2008), who contend that comics are valuable teaching aids that facilitate recalling and recognising abstract concepts by presenting information in visual and verbal formats. Compared to other teaching and learning resources like textbooks, comics can stimulate students' interest in the subject matter, enhance cognitive development, foster creativity, boost learning outcomes, promote self-directed study, and motivate students.

Despite the widespread acceptance of comics as valuable educational tools in many classrooms, it is noteworthy that comprehensive studies have yet to be conducted in the African context. Consequently, the challenges faced by poorly resourced classrooms and the potential disparities in learning outcomes between video- and book-mode comics have yet to be adequately explored. Furthermore, there is a notable gap in assessing the effectiveness of comics within ESL science classrooms, particularly in transitional grades situated within under-resourced learning environments. Additionally, it is essential to ascertain whether comics can be effectively integrated into the framework of Bandura's Social Learning Theory, further underscoring the need for a comprehensive investigation.

Therefore, it is imperative for teachers in under-resourced classrooms to recognise the significance of comic instruction. They can either use their artistic abilities to create comics or utilise existing programs and software. Governmental and regional authorities should support and promote this trend in Namibian schools. This support would be particularly beneficial for students who need to improve in English, as it can help them excel in Science by facilitating the comprehension of abstract scientific concepts through comic-based methods, which have proven effective in conveying scientific information. Consequently, this study aimed to investigate the impacts of video-mode and book-mode comic instruction on learning outcomes, as well as the challenges teachers and students face when implementing comic instruction to enhance the academic performance of English-language students in under-resourced science education settings at the Grade 4 level.

1.3 Statement of the research problem

The academic performance of Grade 4 Science students in the Omusati region of Namibia has consistently fallen below the overall grade mean in various examination periods, including April and November 2018, 2019, 2020, and 2021 (Omusati Regional Advisory Services, 2018, 2019, 2020, 2021). This subpar performance can be attributed to several factors affecting Grade 4 students. One significant factor is the transition from a mother tongue as the medium of instruction to English. Grade 4 students may encounter challenges comprehending the abstract science concepts presented in English, given that they were previously taught in their mother tongue during Pre-Primary to Grade 3 classes. However, it is essential to acknowledge that comics have the potential to make science engaging and more understandable while also fostering a positive learning attitude among young students (Al-Rabaani & Al-Aamri, 2017; Koutnikova, 2017).

Hence, this study aims to assess and contrast the effects of book-based and video-based comic instruction modes in classrooms with limited resources. This study focuses on fourth-grade Science students who face challenges comprehending science concepts in English. Additionally, it investigates teachers' experiences, the obstacles they encounter while creating and delivering such comics in resource-constrained classrooms, and strategies to address these challenges.

1.4 Research questions

The study was based on the following questions:

(a) What are the effects of direct comic instruction on the learning attainment of Grade 4 Science Students?
   (i) What are the effects of video-mode comics on the learning attainment of Grade 4 Science students?
   (ii) What are the effects of book-mode comics on the learning attainment of Grade 4 Science students?
   (iii) What are the differences in the effects of video-mode and book-mode comics on the learning attainment of Grade 4 Science students?

(iv) What are the differences in the effects of video-mode and book-mode comics on the learning attainment of Grade 4 Science students from an urban-based primary school (UBPS) with English medium of instruction and UBPS with mother tongue medium of instruction?

(b) What are the teachers' experiences with comic instruction?

(c) What are the challenges of teaching comics-based Science lessons and what mitigation strategies do teachers use to deal with such instructional concerns?

(i) What challenges do teachers face during the preparation of comics, teaching with comics, and when their students learn with comics?

(ii) How do teachers mitigate the challenges identified in teaching and learning when teaching with comics?

1.5 Hypotheses

The study tested the following hypotheses:

- Teaching that uses video-mode comics has a greater effect on student learning attainments in primary Science than traditional Science teaching.
- Teaching that uses book-mode comics has a greater effect on student academic performance in primary Science than traditional Science teaching.
- Teaching that uses video comics has a greater effect on student academic performance in primary Science than teaching using book comics.
- Teaching that uses video- and book-mode comics has a greater effect in an urban primary school with an English medium of instruction than in an urban primary school with a mother tongue medium of instruction.

1.6 Significance of the research

This study significantly contributes to the existing body of literature in several key ways. First, it extends the scope of previous research by examining the effectiveness of comic instruction in

primary Science classrooms, encompassing both video- and book-mode comics. While prior studies primarily focused on traditional comic books, this research explores the potential benefits of a broader range of comic formats, particularly video-mode.

Second, the study addresses a prevalent, educational challenge—supporting English Second Language (ESL) students transitioning from mother tongue instruction to learning in English. It investigates whether comic instruction can be a valuable tool in improving the understanding of abstract science concepts among ESL students, providing insights into how comics can facilitate their learning process.

Third, the research sheds light on the obstacles that have hindered the widespread adoption of comics in educational settings. By identifying and discussing these barriers, the study offers valuable insights into the challenges associated with comic instruction. It proposes potential strategies for mitigating these challenges, thus paving the way for more effective use of comics in teaching and learning.

Lastly, this study deviates from the traditional role of comics as supplementary teaching aids. Instead, it explores the potential of direct comic instruction, even in the absence of a classroom teacher. This innovative approach expands the possibilities of self-directed learning through comics and highlights their potential as standalone instructional tools.

In summary, this research makes significant strides in advancing the understanding of the role of comics in education. It offers valuable insights into their potential to enhance learning outcomes in primary Science classrooms.

1.7 Operational definition of terms

The following terms and their meanings were restrictively adapted and utilised for this research project:

Video-mode comic: a video format instruction meant to cause enjoyment or happiness in a student while they engage in the subject matter.

Book-mode comic: a book-format instruction consisting of pictures and speech bubbles, which is meant to cause enjoyment or happiness in a student while learning the subject matter.

Learning attainment: the realisation of syllabus-specific objectives after an intervention executed on students.

Urban-based primary school: a primary school based in a municipality-controlled location with availability of almost all basic services like electricity, water connectivity, markets, bookshops, local libraries, and so on.

Medium of instruction: the language used officially as a mode of communication while teaching and learning the subject matter.

Science concept: an abstract idea that is conceived in the mind of a student with or without experiencing the real matter.

Symbolic representation: the process of imaginary representing the subject matter and specific objectives of the syllabus using a symbolic model.

Traditional methods: teaching styles that are commonly used every day and for a long time in Omusati region classrooms.

Specific objectives: a detailed objective that describes what students should do during the lesson, and what is expected from them during the class activity, test, or examination.

Classroom procedures: the routines and actions that occur in the classroom that a teacher and students execute on a daily or weekly basis beyond thinking about them.

Comic instruction: the organised and planned subject content consisting of cartoons, either in video-mode or book-mode, used by teachers to engage students during the lesson.

Comic literacy: the competence or knowledge, or the ability to extract meaning from the way the cartoons are drawn in the book or performed in the film.

Language proficiency: a high degree of listening, speaking, and writing skills in a language that helps students effectively grasp subject knowledge during the lesson presentation.

Mother tongue: the language spoken in the family home of the students, and all around the geographical area where the school is situated.

1.8 Limitations and delimitations

The study has encountered limitations that have influenced its progress beyond my control. The primary limitation pertains to the scarcity of animators. Initially, the plan was to employ comic animation methods to create video-mode comics. Comic animation involves using computer-generated imagery to produce moving visuals in the form of a video.

However, I could only produce a comic video featuring myself with the assistance of a Science teacher who donned mascots (refer to Subsection 3.2.2 and Section 4.10). It is worth noting that comic animation has distinct advantages over comic filming, as it enables animators to digitally craft precise details essential for effectively conveying the lesson's learning objectives to students. Unfortunately, the local area lacked the availability of skilled animators, necessitating my resorting to comic filming as an alternative approach.

The second limitation pertains to financial constraints. Specifically, the Grade 4 students require a book with a font size that is sufficiently large for them to read comfortably. However, due to budgetary limitations, compromises were made in this regard. The initially planned font size and spacing had to be adjusted, resulting in a smaller font size and reduced spacing. This adjustment was made to avoid a substantial increase in the number of pages in the comic book, as a more significant number of pages would incur higher printing costs, particularly when considering colour printing. Consequently, the font size was minimised, and the number of cartoons per specific learning objective was reduced to help manage the associated expenses.

The third limitation pertains to the teachers themselves. It should be noted that the participating teachers needed prior experience or knowledge in creating comics before their involvement in

this study. This gap potentially influenced their responses during the interviews. An illustrative example is one teacher's claim of prior experience with comics, which was later contradicted when asked to provide evidence. In this instance, the teacher could only produce ordinal diagrams from the textbook as purported evidence, prompting further clarification and explanation on the distinctive attributes of images used in comic instruction compared to the conventional images found in the ordinal Science textbook.

Another area for improvement in this study was the need for more access to experts in comic production. Creating new comics necessitates validation by professionals in comic design to ensure their accuracy and effectiveness in fulfilling their intended purpose. Despite extensive efforts to locate such experts, none were found in the areas of animation or filming. Consequently, the comics were validated by senior teachers with expertise in the subject matter. They assessed whether the comics adequately addressed the specific objectives outlined in the syllabus.

Additionally, the timing of the research was influenced by unforeseen circumstances. Initially, the plan was to research before the teachers covered the themes included in the comics. However, the outbreak of the COVID-19 pandemic led to school lockdowns, disrupting the school calendar and making it challenging to adhere to the planned timeline. This unexpected disruption posed a limitation as it affected the ability to assess the impact of the interventions on learning attainment, given that some students might have already been exposed to the subject matter due to the altered study schedule.

In terms of delimitations, careful considerations were made to define the boundaries and parameters guiding this study. Due to their unique characteristics, the decision was made to focus exclusively on Grade 4 Science classrooms. Academic performance in Grade 4 is notably lower compared to other grades, primarily because it marks the transition from mother-tongue instruction to English as the medium of instruction. This linguistic shift could impact students' English proficiency. Additionally, Grade 4 represents a critical juncture where the depth of content in the natural Science subject is significantly expanded following the foundational concepts introduced in Grade 3. Consequently, the introduction of comic instruction was specifically

tailored to address the challenges faced by Grade 4 Science classrooms, particularly those students who encounter language barriers. The study sought to investigate the impact of comic instruction in this context and identify the challenges teachers and students face.

Another significant delimitation involved the selection of the Social Learning Theory of Bandura as the theoretical framework for this study. This theoretical choice was made to explore the potential of comics in delivering lessons to students without the direct involvement of a teacher in the classroom. The Social Learning Theory posits that learning is influenced by modelling and observation, where observers acquire symbolic representations of modelled activities rather than forming specific stimulus-response associations. This framework provided a lens through which to assess the effectiveness of comic instruction as a mode of learning that relies on observational and symbolic learning processes.

1.9 Organisation of the study

To systematically address the research problem, this study is structured into seven chapters, each serving a distinct purpose.

Chapter One introduces the study and offers an overview encompassing the background, problem statement, research questions, hypotheses, significance of the study, and definitions of key terms.

Chapter Two delves into the theoretical framework that underpins this study. It is grounded in Bandura's Social Learning Theory (1971), specifically focusing on observational learning as a fundamental aspect of the theoretical foundation.

Chapter Three conducts a comprehensive review of the existing literature. It examines various facets, including the medium of instruction, cognitive development, the intersection of art and science, the utilisation of comics as a teaching and learning tool, the relationship between arts and science, available comic software and programs, governmental and regional involvement in comic instruction, strengths and limitations of the reviewed literature, and the rationale for conducting the study.

Chapter Four outlines the study's design and methodological approach. This research employed a mixed-methods approach with a concurrent nested design. The quantitative component was addressed through a true experimental design, incorporating pre-post and post-test intervention methods. The qualitative component employed an in-depth interview design that focused on teachers' experiences, encountered challenges, and strategies to mitigate those challenges. This chapter details aspects such as the study population and sample, sampling procedures, data analysis methods, reliability and validity considerations, researcher positionality, consistency and neutrality, pilot testing, the production of comics, and ethical considerations.

Chapters Five and Six represent the core of the study, exploring the effects and challenges associated with using comic instruction in resource-constraint Grade 4 Science classrooms. The research investigates the efficacy of different types of comic instruction in enhancing learning outcomes among Grade 4 students, particularly those grappling with the transition from one medium of instruction to another, namely from mother tongue to English. The study focuses explicitly on introducing video- and book-mode comics into the Science classroom. It also provides insights into the challenges teachers and students face when employing comic instruction and proposes strategies for addressing these challenges.

Chapter Seven serves as the study's conclusion, summarising key findings and presenting recommendations and suggestions for future research endeavours.

1.10 Conclusions

This chapter has provided a comprehensive overview of the historical context of Namibia's language policy, tracing its evolution to shed light on the research problem surrounding comic instruction in Grade 4 Science classrooms. This historical journey began during the colonial era when Namibia was under the rule of Germany, and later South Africa, and it continued through the significant curriculum revisions initiated in 2015. Notably, Namibian students were initially educated in Afrikaans as the medium of instruction during the colonial period. Following Namibia's independence in 1990, the medium of instruction transitioned to English. Subsequent curriculum

revisions have aimed to promote equity, access, quality, democracy, and student-centred teaching methods while providing guidelines for using mother tongue and English as mediums of instruction. Of particular relevance to this study is the policy of instructing students in their mother tongue from Pre-primary to Grade 3, followed by a shift to English as the medium of instruction starting in Grade 4, especially within Science classrooms. This transition to English instruction in Grade 4 has raised concerns due to observed lower performance compared to other grade levels, possibly influenced by challenges related to students' English proficiency. In response to these challenges, comic instruction was introduced in Grade 4 to assess its impact and identify potential challenges that could inform future implementation strategies.

Furthermore, this chapter introduced the study's objectives by outlining the research questions and hypotheses. The research questions sought to evaluate the effectiveness of comic instruction in both modes (video and book) on learning attainment in Grade 4 Science classrooms. Additionally, the study introduced questions to explore teachers' experiences and challenges when preparing comic content and delivering instruction using comic materials. Lastly, the chapter posed questions to explain potential strategies for addressing the challenges identified during comic instruction implementation.

Additionally, this chapter provided an overview of the structure and organisation of the entire study, encompassing each chapter from the introduction to the conclusion. These chapters comprise the following components: the introductory chapter, the theoretical framework, the literature review, the methodology, the presentation and discussion of quantitative and qualitative findings, and a concluding summary of the study. Finally, the chapter underscored the significance of this research, focused on comic instruction within the Science classroom and clarified the specific terms defined within this study's context for precise interpretation.

CHAPTER 2

Theoretical framework

2.1 Introduction

In this chapter, the primary objective is to establish a theoretical foundation for using comics in teaching and learning Science at the primary school level in Namibia. Additionally, I explore how Albert Bandura's Social Learning Theory (SLT) can illuminate the teaching and learning processes within this context.

Albert Bandura's Social Learning Theory posits that learning is inherently a social behaviour that transpires through the observation and imitation of the behaviours exhibited by others (Sutton, 2021). Bandura introduced the social dimension into his learning theory upon recognising that students acquire knowledge not solely through direct reinforcement but also by effectively learning by observing individuals or models as symbolic representations of subject matter (Nabavi, 2012). His theory enhances our comprehension of student learning by bridging the gap that cannot be sufficiently explained by behaviourist and cognitive learning theories alone (Muro & Jeffrey, 2008).

Furthermore, video- and book-mode comics establish a learning platform that mirrors the principles of the Social Learning Theory, as it facilitates behaviour modelling within the classroom setting. Students can observe modelled behaviours within this framework, effectively conveyed through the engaging and motivating features intrinsic to comics.

2.2 The Social Learning Theory of Albert Bandura

Albert Bandura (1925-2021) made significant contributions that revolutionised our global understanding of teaching and learning. Nolen (2022) characterises this Canadian-born American psychologist as the originator of Social Cognitive Theory, best known for his ground-breaking "bobo-doll" experiment, which demonstrated that children can acquire behaviour by observing adults.

In the bobo-doll experiment, an adult subjected a clown-faced inflatable toy to physical and verbal abuse while children observed the actions. Subsequently, the children imitated the behaviour they had witnessed by attacking the toy. This tendency to mimic violent behaviour after exposure to it was consistently confirmed through additional related experiments (Nolen, 2022).

Bandura's work, notably the Bobo doll experiment and related contributions, earned him international recognition in psychology, ranking him just behind Skinner, Freud, and Piaget in advancing the psychology of learning (Kendra, 2020). Bandura was ranked fourth in a 2002 survey aimed at identifying the most influential psychologists of the twentieth century. His contributions to psychology extend beyond the Bobo doll studies and encompass areas such as observational learning, self-efficacy, and social learning theory (Kendra, 2020).

Hence, this study is grounded in the components of Bandura's Social Learning Theory, mainly focusing on observational learning and self-efficacy. Bandura's theory is highly relevant to this study because it emphasises the significance of observation, imitation, and modelling as effective learning modes, all of which are influenced by attention, motivation, attitudes, and emotions (Kendra, 2022).

Bandura posits that modelling and observation are strong learning drivers because observers acquire symbolic representations of modelled activities rather than specific stimulus-response associations. His theory extends beyond behavioural theories, which propose that all behaviours are learned through conditioning, and cognitive theories, which require psychological factors like attention and memory (Fryling et al., 2017). According to Bandura, individuals can learn by observing behaviour either directly through social interaction or indirectly, which in today's context could include learning through social networks.

This study implies that teaching and learning with comics do not necessarily rely on the teacher employing scaffolding and drilling techniques; instead, the teacher assumes the role of a facilitator while students and comic characters take the lead in the learning process.

Bandura's seminal work has delineated three fundamental models of observational learning: first, the live model entails a tangible individual physically demonstrating or enacting a behaviour; second, the verbal instructional model revolves around providing descriptions and explanations of behaviour; third, the symbolic model encompasses instances where actual or fictional characters within various mediums such as books, films, television programs, or online media exhibit behaviours (Kendra, 2019).

Drawing from my study on comics in the context of education, as informed by the symbolic model, it becomes apparent that observational learning is not strictly contingent on an individual directly witnessing someone else participating in an activity. People can acquire knowledge by reading, hearing, or watching characters' actions in books and films (Kendra, 2019). Whether watching fiction or non-fiction films, observing can profoundly influence a person's ability to learn how to respond and experience emotions when faced with similar situations.

Symbolic modelling can be effectively illustrated through an example of an individual who has never engaged in tennis but is handed a racket and a tennis ball. Remarkably, they may display relatively accurate actions in handling the racket and playing the ball, a proficiency likely acquired through prior observation of tennis played on television (Kurt, 2020). Consequently, a substantial portion of knowledge and skills acquired during childhood can be attributed to observational learning, encompassing the acquisition of abilities such as riding a bike, dancing, or playing the guitar. In this realm of learning, distinct from other theories predicated on direct conditioning, reinforcement, and punishment, Bandura's Social Learning Theory finds its distinctive niche (Kurt, 2020). While the Social Learning Theory diverges from alternative theories, synthesising these theories can enhance overall learning outcomes. Therefore, this study seeks to explore the synergistic potential of the Social Learning Theory in conjunction with elements of cognitive development theory, elucidating the value of this partnership within the context of the research.

2.3 Social Learning Theory in conjunction with cognitive-developmental theories on the value of learning with comics

While Bandura's learning theory is primarily rooted in observation rather than relying solely on conditioning, reinforcement, and punishment (Nabavi, 2012), he also acknowledges that mere observation might not suffice for maximal learning (Kurt, 2019). Bandura recognises that motivation and mental health can significantly influence the learning process. Consequently, he aligns with other behavioural theorists in acknowledging the importance of these factors in facilitating effective learning. Thus, Bandura's stance underscores the multifaceted nature of learning, where observation is just one component among several that contribute to knowledge acquisition.

Similarly, as explained by renowned theorists like Jean Piaget and Lev Vygotsky, cognitive development occupies a central role in shaping how individuals acquire and apply knowledge, much like Bandura's perspective. Integrating cognitive development principles into Albert Bandura's Social Learning Theory (SLT) within the context of comic instruction holds great potential for enhancing the effectiveness of this educational approach. This section delves into the rationale behind merging cognitive development concepts with SLT while preparing comic-based instruction, emphasising the synergistic advantages it brings to the table, ultimately fostering profound and enduring learning experiences.

2.3.1 Cognitive development and its relevance to learning

Cognitive development theories, exemplified by Piaget's constructivist theory, illuminate the remarkable characteristics of human cognitive growth (Siegler, 1994). These theories emphasise how students actively construct knowledge, adapt to their environment, and refine their cognitive structures over time. The profound disparities become readily apparent when one compares the thinking of an infant, a toddler, a primary school student, and an adolescent (Siegler, 1994). Even when Piaget's stages of development face contestation and occasional rejection (Knight & Sutton, 2004), it remains evident that students exhibit distinctive cognitive patterns (although they may

not neatly fit what Piaget proposed) over extended periods before transitioning to a new cognitive mode (Siegler, 1994). Therefore, in this study, Piaget's concrete operational stage is not used to categorise all Grade 4 students as homogenous but rather as a broad reference point that applies to most students at that level. This non-homogeneous aspect is where Vygotsky's Zone of Proximal Development (ZPD) is introduced to address any potential gaps left by Piaget's theory.

By integrating these developmental theories into Bandura's SLT, I acknowledge that students are not passive recipients of information but active agents deeply involved in intricate cognitive processes during their social learning experiences. This recognition of students' dynamic cognitive development equips educators with valuable insights into the evolving cognitive capacities of their students. Such insights are invaluable in tailoring comic-based instruction to suit each student's cognitive readiness and developmental stage, enhancing the instructional approach's efficacy.

2.3.2 Enhancing Social Learning through cognitive development

Cognitive development is a valuable lens through which one can gain insights into the cognitive processes underlying Bandura's SLT, encompassing crucial factors such as attention, retention, production, incentive, and intrinsic motivation (Kurt, 2019; Rashid, 2020). The intricate interplay between cognitive growth and social learning manifests in various domains, including observational learning, memory, attention, and problem-solving (Fryling et al., 2017). For instance, cognitive developmental stages profoundly influence how individuals interpret and process information from their social environment, shaping their capacity to model behaviours and internalise learning outcomes.

In motivation as a cognitive process, Bandura's insights extend beyond external reinforcement to encompass intrinsic motivation (Kendra, 2019). Bandura contends that both mental states and motivation wield significant influence in the context of observational learning (Kendra, 2019). For example, learning can occur when students derive a sense of pride in themselves and their school, resulting in satisfaction and accomplishment (Kendra, 2019). Bandura's recognition of intrinsic reinforcement as a determinant of learning highlights the integration of his theory with other cognitive development theories (Kurt, 2019). Aligning social learning experiences with students'

cognitive developmental stages empowers educators to optimise the effectiveness of their instructional approaches.

By incorporating cognitive development principles into SLT, I gain a more holistic understanding of how students engage with and internalise knowledge from their social milieu. This comprehensive perspective enables educators to tailor their instructional strategies to individual students' cognitive readiness and developmental progress, fostering more meaningful and enduring learning experiences.

2.3.3 Cognitive Development and Self-Regulation

A central tenet of Vygotsky's theory revolves around the notion that cognitive development potential is contingent upon the Zone of Proximal Development (ZPD), a stage of development reached through children's engagement in social interactions (Fani & Ghaemi, 2010). The complete realisation of the ZPD hinges on comprehensive social engagement. The array of skills that can be cultivated with the guidance of adults or collaboration with peers surpasses what can be achieved independently (Fani & Ghaemi, 2010). Vygotsky's ZPD draws attention to the significance of scaffolding and social interaction in the learning process, resulting from the guidance provided by an adult teacher. According to Vygotsky, adults are pivotal facilitators of cognitive development (McLeod, 2014). They convey the cultural tools of intellectual adaptation, which children internalise.

Hence, within the scope of this study, the Zone of Proximal Development (ZPD) serves as the domain where students can benefit from social modelling and guidance. When contextualised within the Social Learning Theory (SLT) framework, comprehending the ZPD in the context of cognitive development clarifies how students can be effectively nurtured to ascend to higher levels of self-regulation and self-control (McLeod, 2014). This profound insight equips educators with the knowledge required to discern the optimal timing and nature of interventions, thereby cultivating a cohort of increasingly autonomous and self-directed students.

Therefore, this amalgamation of Bandura's theory with other cognitive development theories underscores the paramount significance of this study. The investigation is aimed to assess the efficacy of exclusively employing comics as a pedagogical tool to explain Science concepts to students. However, the presence of a teacher in the classroom emerges as an indispensable component of effective teaching and learning, as elucidated by the ZPD concept. While comics can be a potent instrument for instructing students due to their inherent motivational elements, which enhance student engagement and information retention, it is vital to recognise that some students may face challenges, such as learning difficulties. In such instances, a teacher can provide essential scaffolding and support to ensure that every student thrives in the learning process.

Nevertheless, while the characters portrayed in comics serve as effective models for delivering subject content to students with reduced reliance on external rewards, teachers play a pivotal role in nurturing and sustaining students' motivation. They foster a classroom environment conducive to intrinsic and extrinsic reinforcement. Despite the indispensable role of teachers in the classroom, the efficacy of self-explanatory comics remains undiminished, particularly in scenarios where teachers may be absent. This self-explanatory aspect highlights the value of comic-based instruction, as employed in this study, which can be recommended for educating students at home or during school closures triggered by natural disasters like floods or pandemics. As argued by Syslak (2020), this feasibility arises from the fact that comics possess the inherent ability to effectively convey subject matter even in the absence of a teacher. The proficiency of comics in elucidating subject content without direct teacher involvement can be attributed to their potency in symbolic modelling, aligning with the principles of SLT.

2.4 Comics: an SLT symbolic modelling tool

Comics are often hailed as self-explanatory educational materials within the classroom setting (Syslak, 2020). This intrinsic quality implies that comics can explain their content without external explanations, thereby facilitating the achievement of educational objectives. Notably, comics integrate visual imagery and text, endowing them with a multidimensional nature that enhances their comprehensibility (Gyurjyan, 2019). According to Gyurjyan (2019), the human brain tends to

fully comprehend and decipher comics primarily because this medium affords ample space for imaginative engagement. Consequently, even the most intricate and abstract subject matter becomes more accessible when presented in comic book format than in traditional text-only literature (Gyurjyan, 2019). For harnessing the self-explanatory attributes of comics, this study adopts Bandura's Social Learning Theory (1971), grounded in the concept of observational learning, to expound on how comic characters can serve as models for subject matter, inspiring Grade 4 students to emulate them and thereby enhance their learning outcomes.

Bandura's Social Learning Theory (SLT) emphasises the significance of cognitive processes that underpin successful observational learning. Within the framework of SLT, these cognitive processes encompass attention, retention, production, incentive, and motivation (Rumjaun & Narod, 2020). Notably, these cognitive processes demand a substantial level of engagement and effort on the part of students. The degree of effort invested in observing the model correlates with the extent of learning that transpires. In practical terms, this implies that after attentive observation of the model, students functioning as observers can recall and retain essential facets of the subject matter. This retention is instrumental in enabling the observer-student to replicate what was modelled through the mental visualisation of the subject matter (Rashid, 2020).

Furthermore, students acquire knowledge by formulating a mental representation of the modelled behaviour and applying it in practical contexts. This knowledge is further reinforced through verbalisation of the observed events (Rumjaun & Narod, 2020). Students must progress through a production phase following observation to achieve successful learning outcomes. For instance, after observing comic characters engage in an experimental activity, students must undertake a corresponding practical application. Essentially, they must translate mental images and verbal constructs into tangible behaviours (Rashid, 2020).

The final phase involves the incentivising or motivation that should accompany or follow the modelled activity. Regardless of comics' attention and retention capabilities, students still need incentives or motivation to replicate the behaviour they have observed successfully. When

students are adequately motivated, the process of observation naturally transforms into actionable behaviour (Rumjaun & Narod, 2020).

It is important to note that the need for motivation highlights a key distinction: the automatic imitation of behaviour does not constitute observational learning. Instead, observational learning represents a conscious decision on the part of the observer to visualise or imagine a particular behaviour that has been observed but not directly experienced. In understanding the modelling nature of comics, three factors that influence this modelling process can be explained: the characteristics of the models themselves, the types of observers involved, and the consequences or rewards associated with the observed behaviour (Rashid, 2020).

To effectively model activities with students, comics should possess specific attractive characteristics. They should be relatable to students, aligning with their age and experiences. The characteristics of the observers, such as age, gender, culture, and other traits, also play a significant role in determining how effectively the model can be imitated. Lastly, for students to engage in imitation, a rewarding element should be associated with successfully replicating the behaviour (Rashid, 2020). Consequently, well-crafted comics that encompass these appealing attributes can create a positive learning environment where students actively participate in their education, with the teacher assuming a supervisory role. This aspect of student participation underlines the potential of comics to reinforce a student-centred approach in the Science classroom.

2.5 Comic instruction and the student-centred approach

Integrating comic-based learning within the Social Learning Theory (SLT) framework can reinforce a student-centric approach in the classroom, broadly encompassing pedagogical methods that shift the focal point of instruction from the teacher to the student. In the context of Namibian education, educators often grapple with the implementation of student-centred learning approaches, as evidenced by studies conducted by Awe (2007), Amakali (2017), and Haimbangu

(2018). Comic instruction can be a valuable tool to facilitate the realisation of this student-centred instructional paradigm.

It is important to note that SLT is fundamentally distinct from the traditional instructor-centric approach that predominantly underpins conventional learning methodologies. Traditional pedagogical paradigms are frequently rooted in behaviourism, which posits teachers as the exclusive sources of knowledge within a given subject domain (Hart, 2007)). However, the present study aligns with the core tenets of SLT, which postulate that when students engage with Science content presented in comic format, they are more likely to engage in self-directed learning. SLT allows students to observe modelled activities and subsequently replicate them through imitation. In this process, students actively participate in the subject matter, as exemplified in the scenario described in Section 5.2. Significantly, this form of learning transpires without direct teacher involvement, as students learn through observation and imitation, employing the materials provided for self-directed learning without explicit instructions or directives from a teacher.

Self-directed learning is naturally aligned with comic instruction, primarily owing to the intrinsic motivation it instils in students. This intrinsic motivation is a compelling driving force, resulting in heightened attentiveness during lessons and an enhanced capacity for information retention (Hill et al. (2009). The students' voluntary inclination to fully engage with the entire presentation, absent external coercion, is a testament to the intrinsic motivational aspect inherent in comics. With such positive student attitudes and the intrinsic motivation catalysed by comics, students can be more proactive in directing their learning trajectory. At the same time, the teacher transitions into the role of a facilitator within the classroom (Hill et al. (2009). Tabulawa (2003) supports this analogy by describing the student-centred approach as students actively participating in the learning process rather than passively receiving factual knowledge from the teacher. For instance, during the intervention phase of this study, a group of students who had engaged with comics attempted to collect heat radiating from a fire using a jar. Their unsuccessful attempts eventually led them to acknowledge that heat is non-matter, devoid of mass, and incapable of occupying space. This student-centred scenario within the study highlights the

potential for comics to cultivate self-directed capabilities that can significantly contribute to self-influence.

Proponents of the notion that humans possess inherent self-directing capabilities argue that effective learning transpires when students actively contribute to their motivation through self-influence. This perspective finds resonance in Bandura's work (1985). In light of this perspective, it is evident that while comics inherently possess an attractive quality, the effectiveness of comic instruction truly materialises when students autonomously motivate themselves, thereby catalysing the realisation of a student-centred approach (McCabe & O'Connor (2014). Consequently, within the framework of Social Learning Theory (SLT), comic instruction emerges as a potent and well-suited pedagogical approach, particularly in the context of Science education. Comics are well-suited because the teaching of Science necessitates heightened student engagement to attain productivity and meaningful learning outcomes

2.6 Social Learning Theory and Science teaching

Comic instruction has been selected as the pedagogical approach to tackle the research problem in this study due to its capacity to address pivotal components of motivation and self-efficacy within the context of a Science classroom. These factors hold intrinsic significance in Bandura's Social Learning Theory (SLT) framework. In concurrence with this perspective, Rumjaun and Narod (2020) demonstrated the effectiveness of instructional strategies aligned with SLT in enhancing learning outcomes within science education. Consequently, comic instruction is an integral component of SLT, offering a potent and valuable tool for facilitating the teaching and learning of science.

The relevance of SLT in the realm of science education is underscored by the exigency of nurturing students' acquisition of science process skills, which necessitates active engagement through group activities, role-playing, problem-solving projects, and the conduct of scientific inquiries to comprehend complex scientific concepts, issues, and phenomena (Rumjaun & Narod, 2020). Science is not only a means of comprehending scientific concepts but also a method for discerning

their construction. Therefore, SLT aligns seamlessly with the pedagogical underpinnings of science education. The intricate and abstract nature of scientific subjects demands substantial effort from students to achieve comprehension, thereby underscoring the pivotal role of motivation and self-efficacy, as expounded in SLT (for further elaboration, refer to Sections 2.5 and 5.2).

The assertions put forth by Rumjaun and Narod (2020) are corroborated by the findings of Ugwuanyi et al. (2020) in their investigation into psychological predictors influencing the academic achievement of physics students. Their empirical research conclusively establishes that motivation and self-efficacy, as delineated by Bandura, exert a profound influence on students' performance within the physics classroom. In light of these findings, Ugwuanyi et al. (2020) advocate for a transformative shift in physics instruction, emphasising strategies aimed at bolstering students' motivation and self-efficacy, positing that such an alteration would invariably yield improvements in academic attainment.

Therefore, by virtue of the inherent self-efficacy facets embedded within SLT, the choice of comic instruction was made to address the challenges associated with teaching science to Grade 4 ESL students. Besides the crucial roles played by motivation and self-efficacy in science education as outlined in SLT, symbolic modelling, a component of observational learning, is recognised as a fundamental element for acquiring scientific knowledge (refer to Section 1.2). It is important to emphasise that within the framework of Social Learning Theory (SLT), which underpins this study, symbolic modelling highlights the idea that actual or fictional characters in diverse forms of media, including literature, cinema, television, and online platforms, demonstrate behaviours that can be emulated and absorbed (Kendra, 2019). This rationale led to the selecting of comics in both formats as symbolic models for presenting the subject matter. Evagorou et al. (2015) argue that using visual depictions, including photographs, diagrams, and models, is a crucial component of the scientific field. Their incorporation allows scientists to engage with and illustrate complex phenomena that are otherwise unobservable. Visualisations assist students in forming a mental image that can enhance their comprehension of abstract scientific concepts; hence, comics may facilitate a better understanding of science for students than other approaches.

However, it is imperative to acknowledge that this selection of SLT as the theoretical framework was made judiciously, with due consideration of the attendant challenges and criticisms directed at SLT. This critical perspective was adopted to gain a nuanced understanding of the theory's limitations and explore avenues for their mitigation.

2.7 Challenges and critiques of Social Learning Theory

In a critical review of the theory and application of Social Learning Theory (SLT) in participatory natural resource management conducted by Muro and Jeffrey (2006), SLT is recognised as a valuable framework for facilitating an effective participatory and deliberative process in this field. However, while acknowledging the social learning outcomes associated with such processes, they also raise important questions and concerns about the limitations and challenges of social learning. These concerns revolve around whether participatory processes can genuinely foster shared understanding, whether they might hinder transformative change, and whether they contribute significantly to the overall process outcomes (Muro & Jeffrey, 2006). These questions highlight significant challenges, including the difficulty of qualifying and measuring how social learning occurs as part of internal change processes. Additionally, the lack of definitive concepts related to social learning makes it challenging to determine whether SLT should be regarded as a process, an outcome, or both.

Given the concerns associated with Social Learning Theory (SLT), particular attention must be directed toward designing and producing comics to address these challenges. It is imperative to validate the comics' content and ensure that it engages most students, enhancing the learning outcomes throughout the process. The careful consideration of character selection in comic production is essential, as individual students may undergo varying degrees of internal change during and after observation. Suico (2019) supports this concern by highlighting that while much of human behaviour is learned through observation, individuals can observe behaviour without actually learning from it.

For maximising the effectiveness of comics as a teaching and learning tool, it is crucial to craft them in a manner that encourages students to imitate the modelled behaviour and contributes to the overall learning process. Bandura's recognition of the challenges inherent in observational learning reveals the complexity of the social learning process, particularly in comparison to behaviourist theories that emphasise permanent behaviour change (Suico, 2019). Hence, observational learning suggests that students may acquire new information through observation without necessarily exhibiting immediate behavioural changes.

In addition to the limitations and challenges associated with social learning, some researchers have criticised Bandura's theory. However, considering the critics of Bandura's SLT could assist in developing comics for this study with minimal weaknesses. One of the criticisms of the symbolic modelling of SLT is that there is a risk associated with observing negative actions. When the action mimicked by the observer is adverse, it can offend or harm people (Nabavi, 2012). For example, this is possible if comic characters are designed to be gender, religion, or culturally insensitive.

Therefore, the development of comics in this study was guided by the constant awareness that comic characters should be presented positively, not negatively, to affect students. This awareness has helped me to understand the SLT better, so I can still associate my comic studies with it rather than other learning theories.

2.8 Associating comics with SLT rather than other learning theories

The foundation of this study lies in Social Learning Theory (SLT), and this section will explore various learning theories to determine which ones can be integrated with SLT and which are not pertinent to the study. Therefore, while this study is grounded in SLT, it highlights how SLT can serve as a crucial bridge connecting behaviourist and cognitive developmental theories. This linkage underscores the potency of comic instruction in the context of science education, which often demands intrinsic motivation for grasping abstract scientific concepts and hypothetical phenomena.

Nevertheless, it is essential to recognise that even intrinsically motivated students require an effective classroom environment with strong discipline and management for optimal learning outcomes. As such, comic instruction primarily aligns with SLT, but it also benefits from insights drawn from other educational theories. In the following section, I delve into the theories of B. F. Skinner, Sigmund Freud, and Jean Piaget to further explain why comics find strong alignment with SLT, partly integrating some and completely `not aligning with others.

2.8.1 Skinner's Operant Conditioning Theory

Operant conditioning theory, developed by the behaviourist B. F. Skinner, is founded on the concept that all human actions directly result from conditioning. Skinner's perspective posits that behaviour stems from exposure to a stimulus, followed by a response, and then by the reinforcement of that response (Cherry, 2022). In this framework, reinforcement plays a pivotal role in shaping behaviour by either providing a stimulus to strengthen it or removing an unfavourable outcome. Reinforcement can be categorised as positive or negative. In addition to reinforcement, Skinner's learning theory also encompasses punishment, where students may be subject to positive punishment by administering a negative reinforcer or removing a positive reinforcer, constituting negative punishment (Cherry, 2022).

As McLeod (2018) points out, individuals tend to repeat reinforced or rewarded behaviours while discontinuing those punished. This concept aligns with Thorndike's law of effect (1898). In the context of the Skinner box, an operant conditioning chamber, animals receive rewards for pressing a lever or pecking a key. Similarly, people learn by experimenting with various behaviours and adjusting based on the consequences (McLeod, 2018).

Operant conditioning theory is closely tied to rewarding students during an intervention rather than afterwards. Reinforcement operates in conjunction with the stimulus to make a response more effective. In comics used for teaching and learning, reinforcement is optional, primarily because teachers were not directly involved in the instructional process. Consequently, operant conditioning theory finds limited applicability to comics regarding classroom control and management. In this case, it is less pertinent since students were engrossed in observing the

modelled activities, leaving little room for disruptions. However, it is worth noting that comics, when implemented under the framework of Social Learning Theory, may pose challenges related to classroom management if they are not well-designed to keep students thoroughly engaged.

2.8.2 The learning theory of Sigmund Freud

Freud proposed that childhood events and experiences are pivotal in shaping adult behaviour. One of Freud's theories, psychosexual theory, outlines four stages of desire in libido: oral, phallic, latent, and genital. It suggests that children should be appropriately guided through each of these stages to foster responsible adulthood in the future (Mutinda, 2017). According to Freud's theory, human behaviour is primarily determined and regulated by unconscious memories, thoughts, and urges (Cherry, 2022). Libido, described as a psychosexual energy, is seen as the driving force behind human behaviour.

Mutinda (2017) emphasises the importance of addressing specific issues within prescribed stages to prevent fixation. Fixation refers to an adult's behaviour being "stuck" in an earlier stage of development until the underlying conflict is resolved. For example, someone who did not successfully navigate the oral stage of development might exhibit fixation on oral aspects and might seek gratification through behaviours like smoking, drinking, or overeating (Cherry, 2022).

While Freud's theory may have relevance in students' personal lives, it lacks direct and immediate applicability to the teaching and learning of science through comic instruction. It is also challenging to test Freud's theory in the context of comics, as it deals with unconscious memories that may not be easily traced. Therefore, this theory does not align closely with comic instruction.

2.8.3 Cognitive Development Theory

Jean Piaget's cognitive development theory posits that intelligence does not solely rely on classroom knowledge acquisition but evolves as a child matures (McLeod, 2022). Children construct an internal mental model of the world as they grow rather than solely relying on external formal education. Cognitive development undergoes distinct stages as children interact with their environment, with Piaget delineating four stages: sensorimotor, preoperative, concrete, and

formal operations (McLeod, 2022). The concrete operational stage, relevant to Namibian Grade 4 students aged seven to eleven, signifies a critical phase where logical and operational thinking significantly advances (McLeod, 2022). This stage enables problem-solving through mental processes rather than just physical actions. Piaget, however, cautions that operational thought requires the physical presence of materials; otherwise, abstract and hypothetical problems can overwhelm children (McLeod, 2022).

Piaget contends that children's cognitive development limits their grasp of advanced concepts that might exceed their developmental stage (Nortje, 2021). Nonetheless, cognitive capacity grows with age, influencing their knowledge and understanding. Piaget's theory aligns slightly with comic instruction in the Science classroom than other learning theories, informing decisions regarding effective comic styles and characters for Grade 4 students, who might struggle with abstract science concepts (Nortje, 2021).

Aside from Piaget's developmental theory, Vygotsky's theory provides additional insights into why comics may not entirely conform to it, and it identifies specific aspects of Vygotsky's theory that could be integrated. Vygotsky underscores the Zone of Proximal Development (ZPD) in cognitive development, emphasising the role of social interactions (Fani & Ghaemi, 2010; McLeod, 2014). Skills developed through adult guidance or peer collaboration surpass solitary achievements. Although comics partly align with Piaget's and Vygotsky's theories, there are disparities, particularly concerning Vygotsky's emphasis on cultural influences, while Piaget posits rigid universal stages of cognitive development (McLeod, 2022).

Vygotsky's theory's emphasis on cultural influence can complement Piaget's developmental stages in the context of this study's sample of four schools. Piaget elucidates how discrete stages shape cognitive development, whereas Vygotsky focuses on how the environment impacts learning. This difference emphasises the importance of recognising that students from diverse backgrounds may interact with comics differently, even if they share the same cognitive developmental stage. The complementarity of these theories is also particularly pertinent when examining the influence of the medium of instruction (MOI) on the comprehension of abstract science concepts, given the

disparity in Piaget's and Vygotsky's approaches to language development. Piaget posits that language depends on thought for development. At the same time, Vygotsky suggests that thought and language are initially distinct, merging around three years of age to produce verbal thought (inner speech) (McLeod, 2022).

In summary, although cognitive development theories play a role in enhancing Bandura's Social Learning Theory (SLT), their direct involvement in comic instruction is limited. The primary theoretical framework for this study remains Bandura's SLT to enhance learning capacity.

2.9 Conclusion

The study was examined through the theoretical framework of Social Learning Theory (SLT) because the video and book comics central to this research were influenced by Bandura's symbolic model of observational learning. In this context, comic characters serve as symbolic models capable of replacing the teacher in the classroom, with the teacher assuming a passive role and students taking charge of their learning by imitating the modelled activities.

Bandura's Social Learning Theory (1971) was particularly apt for investigating comic instruction in this study, given the parallels between comic characters and characters in movies, television programs, and online media. This explanation suggests that students can learn from video and book comics. These comics enable students to visualise characters' reactions and emotions, facilitating the acquisition of appropriate responses and emotional understanding in real-life situations. Consequently, this study embraced Social Learning Theory as it has the potential to illuminate a student-centred approach, as comic instruction empowers teachers to be passive facilitators in the learning process.

CHAPTER 3

Literature review: the efficacy of comic-mode instruction in Science classrooms

3.1 Introduction

The primary objective of this literature review is to critically synthesise the existing body of literature pertaining to the utilisation, obstacles, and efficacy of comics as instructional tools in primary school Science classrooms. Secondly, it seeks to analyse the significant insights and notable limitations within the literature concerning the integration of comics in teaching and learning. Lastly, this review explains how my study can address existing gaps in the relevant literature, particularly in the context of employing comics within under-resourced Grade 4 Science classrooms.

To establish the groundwork for this research on the influence of comics in science education, it is essential to initially examine the comprehensive body of literature related to the medium of instruction (MOI). The choice to engage with this broader subject matter stems from the critical concerns that have surfaced within Grade 4, a transitional phase where students transition from their mother tongue to English as the predominant medium of instruction. The MOI, although not directly related to comics, holds profound implications for teaching science and language acquisition in this context. Therefore, this preliminary literature exploration into the MOI is a necessary step to comprehend how different researchers have perceived its effects on science education. It provides a contextual backdrop for my investigation into the potential benefits and challenges of integrating comics into this transitional phase.

3.2 Literature review

The literature review is structured into subtopics that examine previous research findings related to teaching and learning with comics. It identifies and emphasises valuable insights that can enhance the utilisation of comics in the science classroom. First, I reviewed the literature regarding the impact of the MOI on the teaching and learning of Science. Second, I directed my attention to the various types of comics and their constituent elements and explored their utility as a teaching

and learning tool. The discussion on the use of comics reveals their efficacy in the classroom. Notable benefits to be explored include the positive impact on students' attitudes, the role of comics in addressing misconceptions and enhancing academic achievement, their contribution to the knowledge and understanding of primary school students, their promotion of creativity, and their appeal to students who may have had limited interest in learning science.

Third, the literature findings regarding the effectiveness of comics in the science classroom are connected to the potential for comics to usher in a new educational paradigm where art is integrated into STEM (Science, Technology, Engineering, and Mathematics) subjects. This shift can lead to increased creativity in teaching and learning, fostering the development of students' skills and competencies essential for the demands of the Fourth Industrial Revolution (IR4.0).

Fourth, to maximise the benefits of comics for learning and effectively incorporate the arts into science education, students' cognitive development and learning processes are briefly discussed. This discussion serves as guidance for the comics' production team, ensuring that students' age and cognitive abilities are considered when crafting the comics.

Fifth, the success of the comics' production team relies on their skills and creativity. Recognising that not all teachers may possess drawing or creative abilities, I discussed the availability of various comic software and programs. This exploration of available comic software aims to encourage teachers to refrain from utilising comic instruction due to potential limitations in drawing or creative skills.

In addition, I emphasised the importance of central and regional government involvement in the procurement of comic software packages and the training of teachers in comic instruction. This involvement is crucial for the successful implementation of comics in the classroom, as highlighted in the literature.

Lastly, I reviewed the strengths and limitations of the scholarly literature on comic instruction. This review served as a foundation for my study, enabling it to contribute to and expand our understanding of the potential of comic instruction in educational settings.

3.2.1 Medium of Instruction (MOI) and learning science

The foundation of my investigation is the issue of poor academic performance among Grade 4 students in the Omusati region. Grade 4 is a pivotal transitional grade, where students encounter Science instruction in English for the first time after being taught in their mother tongue up to Grade 3 (Ministry of Education, Arts and Culture, 2016). This linguistic shift has significantly impacted their academic performance, as they now grapple with Science in a language they are not proficient in (Evans & Nthulana, 2018). As discussed in Section 1.2 of this study, the MOI plays a critical role in teaching Science, as students must possess language proficiency to grasp abstract scientific concepts.

The language issue highlighted in this study does not explicitly argue against teaching students in their mother tongue during the junior primary phase. Instead, it focuses on the impact of transitioning from the mother tongue to English in Grade 4, which is likely to affect language proficiency and, consequently, the learning outcomes in Science. It is important to note that in some countries, like China, the mother tongue is effectively used as the medium of instruction throughout all grades, such as Mandarin in elementary and secondary schools (World Education News Review (WENR), 2019). In contrast, Namibia has no option for learning in the medium of mother tongue throughout, as all students must transition to English in Grade 4 (Ministry of Education, Arts and Culture, 2016). While teachers in South Africa also express concerns about the impact of transitioning from local languages to English in Grade 4, their situation differs from that .in Namibia (Evans & Nthulana, 2018). To delve further into this matter, I can examine the findings of other researchers in the specific area of the language of learning and teaching (LoLT).

According to the language policy in South Africa, as Probyn (2006) explained, students should receive instruction in 11 official languages, but this policy still needs to be implemented. In practice, English predominates, yet most students need more English language proficiency to engage with the curriculum effectively (Probyn, 2006). This language proficiency deficit hinders their comprehension of scientific concepts. The issues surrounding the language policies in Namibia and South Africa highlight the challenges associated with the medium of instruction

(MOI), showcasing government efforts to incorporate local languages as mediums of instruction, even though English remains the preferred choice for most of the population.

In elucidating the reasons behind the majority of South Africans opting for English as the LoLT after the initial four years of schooling, de Wet (2002) identifies two pivotal factors that may have influenced this choice. One factor pertains to the number of English speakers, while the other factor is related to perceptions of language's role and functions in various aspects of life. English is widely regarded as a significant language in politics, education, Science and technology, trade and industry (de Wet, 2002). This reality has, regrettably, limited the opportunity for South African children to receive instruction in their mother tongue without transitioning between languages, which could have addressed the issue of language proficiency.

Mammino (2010) underscored the pivotal role of language proficiency in shaping students' development of scientific thought and, critically, their acquisition of scientific knowledge within the classroom. This observation aligns with the Ministry of Education's stance in Namibia, as reflected in their language policy, which mandates using the mother tongue as the medium of instruction from pre-grade to grade 3, transitioning to English from Grade 4 onwards (NIED, 2003). The rationale behind this policy is grounded in the belief that learning Science in one's mother tongue enhances students' familiarity with scientific concepts and methodologies. It highlights the undeniable importance of language proficiency, as students are inherently more proficient in their mother tongue than in any other language. Mammino (2010) finds support in Chi et al. (1994) and Evagorou et al. (2015), who emphasise the need for special attention to address the abstract nature of scientific concepts for enhanced comprehension. They also highlight the significance of language proficiency as a crucial factor in facilitating conceptual change in the field of Science.

Furthermore, Mammino (2010) expounded on how the mother tongue as a medium of instruction can enhance students' visual literacy, logical reasoning, and abstract thinking skills. The argument put forth is that students should employ their mother tongue to engage with scientific subjects until they have acquired a sufficient level of familiarity with scientific concepts. This approach would enable students to understand better and identify scientific concepts when using other

languages, such as English. This argument is supported by Nishanthi (2020), who states that mother tongue language is crucial for several reasons, as it shapes a person's thinking and emotions, supports comprehensive child development, and connects them to their culture. Proficiency in the mother tongue enhances cognitive development and aids in learning other languages. Children initially understand their surroundings through the language they hear from birth, and many struggle in schools where instruction is in an unfamiliar language, leading to limited learning and high drop-out rates. For improving education quality, language policies should consider mother-tongue learning, especially in the early years, as it enables more effective teaching and learning (Nishanthi, 2020).

In making this argument, the researchers did not account for the fact that even though students may feel comfortable learning through their mother tongue from pre-grade to Grade 3, the challenge of proficiency would persist when they transition to Grade 4 and begin learning in the medium of English for the first time. This consideration led me to conduct an investigation involving two schools situated in a similar environment. One school employed the mother tongue as the medium of instruction at the Early Childhood Education level, while the other utilised English.

Studying the difference in performance between the two schools with different language policies may inform the lawmakers to make well-informed decisions. While using the understanding that the MOI in the mother tongue is crucial to students in Early Childhood Education, they should also put in mind the student's struggles associated with language transition. The struggle related to language transition is supported by Rollnick (2000), who cautionary notes that decisions about language use in the classroom often stem more from political considerations than from evidence-based best practices. Thus, in addition to examining the disparities between the two schools (School S1 and S4), my research aims to investigate whether the integration of comics into the language transitioning grade can aid students in comprehending abstract science concepts while adhering to the existing language policy. Below, I delve into a detailed discussion of comics to provide a comprehensive understanding of their nature.

3.2.2 Different types and elements of comics

Comic literacy is an essential prerequisite for teachers and students when using comics for educational purposes. Proficiency in deciphering the content of book- and video-mode comics and comprehending the messages they convey necessitates a foundation in comic literacy. This proficiency encompasses a grasp of various aspects, including the structural composition of comics, the distinctions between book and video comics, and a comprehensive understanding of their constituent elements whenever applicable.

The comic book consists of a series of comic strips detailed by Wijaya et al. (2021). In the context of my study, the term "comic book" refers to the book-mode comics utilised, comprising a total of 9 comic strips. Each comic strip addresses a specific sub-topic within the Natural Science subject. For instance, the nine comic strips featured in my comic book covered sub-topics such as ecosystems, matter, identification of states of matter, types of soils in Namibia, water in our surroundings, the water cycle, various energy types, sources of energy, and the role of sunlight in our daily lives (refer to Section 4.10). These nine comic strips had an average of 7 frames per strip. Drawing the book-mode comics took me a week while creating the video-mode comics took two days.

It is important to note that these comic strips can be categorised into two types: picture and text-picture, as Zhao and Mahrt (2018) explained. Picture comics predominantly rely on visuals to convey the intended message or information, whereas text-picture comics incorporate words and images to present the information effectively.

In the context of text-picture comics, textual elements are conveyed within speech balloons, enabling characters to express speech, reflections, thoughts, and other forms of communication. Zhao and Mahrt's (2018) study emphasises the effectiveness of text-picture comics, the very type employed in this study. Remarkably, even novice comic readers find text-picture comics more accessible than purely picture-based comics. The latter can pose challenges as they demand readers to possess a certain level of graphical literacy and skills. Therefore, educators keen on utilising comic instruction may benefit from investing time in familiarising themselves with the

mechanics of comics. This understanding can enhance their comprehension of comics and contribute to improved academic outcomes among students (Difference Engine, 2018).

As noted by Poai (2018) and further elucidated by Difference Engine (2018), comic strips comprise various essential elements. These constituent components encompass pictures (composition), panels, lettering (captions), balloons (speech or thought bubbles), and borders (Wijaya et al., 2021). Pictures are the primary element within comic strips, conveying characters' appearances, actions, and facial expressions. Panels, on the other hand, provide the structural framework for presenting all other elements within the comic strip. These panels may take on various shapes, such as rectangles, squares, or triangles. Lettering or captioning is crucial in setting the stage and guiding the reader's understanding of forthcoming events (Difference Engine, 2018; Wijaya et al., 2021).

In the realm of dialogue, speech bubbles with straight-pointed edges are employed when characters engage in verbal communication. At the same time, those with bubble-edged contours are utilised to convey characters' thoughts. Borders, comprising the lines that enclose panels, balloons, and dialogues, define the boundaries and organisation of the comic strip (Difference Engine, 2018; Wijaya et al., 2021). Collectively, these elements harmonise to create a cohesive comic strip, effectively conveying messages and information to readers. Figure 3.1 provides a visual representation elucidating the different components of a comic strip.

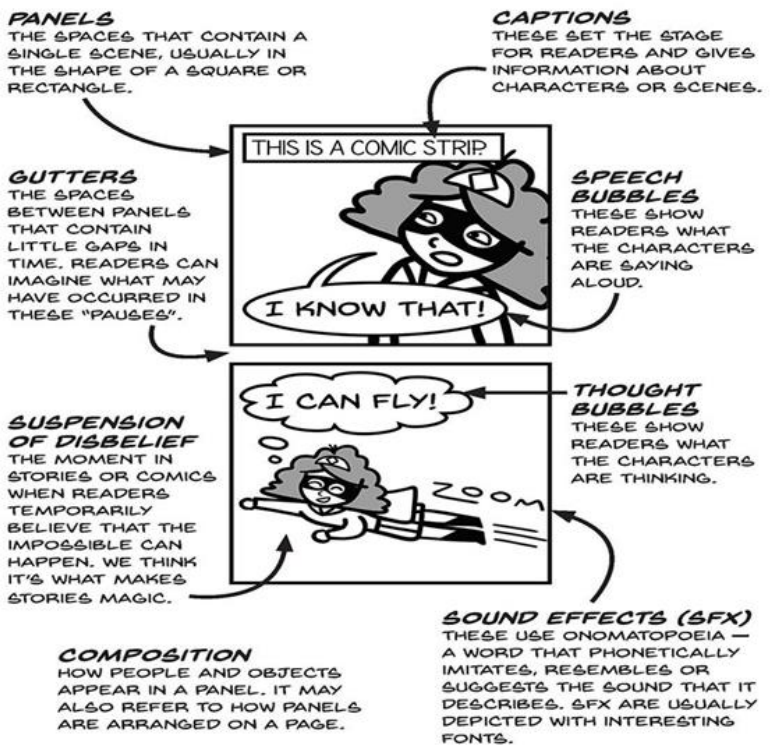


***Figure 3.1**: The elements of book-mode comics (source: Difference Engine 2018)*

Contrastingly, but still significantly informative with regard to comprehending book-mode comics, Akcanca (2020) introduces a distinct set of five elements that differ from the elements outlined by Wijaya et al. (2021) and Difference Engine (2018). Akcanca (2020) delineates these comic elements as language, time, theme, graphics, and characters. In the context of book-mode comics, characters can encompass both the central characters and secondary figures who play supportive roles within the narrative. Often, comic titles are derived from the names of the primary characters featured in the storyline. As Tuncer (1993) and Avarogullari and Mutlu (2019) noted, these characters can embody a wide range of identities, including male or female individuals, and sometimes even take the form of flora or fauna-inspired entities.

Regarding the language element, Akcanca (2020) emphasises that the language employed in book-mode comics differs from the formal academic language typically encountered in school textbooks. Instead, the language utilised in book-mode comics often aligns with the vernacular spoken by students in their everyday lives, bridging the language used on the streets, at home, in

playgrounds, in shopping malls, and the academic language encountered in textbooks and classrooms. According to Krashen (1993), amalgamating these two language varieties impacts students' learning experiences within the classroom positively. Furthermore, the language element is reinforced through the use of various types of speech bubbles in book-mode comics, each conveying distinct vocal qualities such as whispers, shouts, or thoughts. These distinctions are visually represented through the presentation of the bubbles themselves. For instance, speech bubbles indicating whispers are depicted with broken lines, while those for shouting employ bold capital letters, and thinking bubbles manifest as cloud-like shapes adorned with smaller bubbles emanating from the characters' heads.

Akcanca (2020) characterises the time element within book-mode comics as the capacity of comics to transport readers through time, allowing them to navigate both forward and backwards in the narrative. This temporal dimension can be discerned by closely examining the visual cues related to clothing styles and architectural depictions within the comic. Conversely, the theme element is explained as the contextual backdrop against which the comics unfold. Lazarinis et al. (2015) expound on the theme element within comics as the specific subject matter corresponding to a particular educational level or grade.

As described by Akcanca (2020), the graphic element strategically uses images to convey the comic's message to readers effectively. Book-mode comics are ideally crafted to facilitate a seamless narrative flow, ensuring a harmonious interplay between the images and textual content, allowing for a cohesive storytelling experience.

Within the domain of video-mode comics, extant scholarly literature describes two distinct video formats. These categories are denoted explicitly as live-action videos and animated videos, as expounded upon by Champoux (2005), Smith et al. (2012), Hooks (2019), and Suto (2022). According to Hooks (2019), live-action videos feature actual individuals engaged in enacting ideas, serving diverse purposes such as information dissemination, entertainment, or educational content. These videos are characterised by their grounding in tangible physical locations, equipment, and real-world resources. In contrast, animated videos manifest as a digital medium

primarily comprising meticulously arranged static images or computer-programmed sequences. With the sequence of static images, skilled artisans navigate through this assemblage of images rapidly, thereby creating the perceptual illusion of a dynamic and moving entity (Smith et al., 2012; Hooks, 2019). As a result, animated videos emerge as a potent medium particularly suited for representing activities that transcend the constraints of the physical world.

Moreover, Hooks (2019) and Suto (2022) contend that animated videos can be categorised into two distinct types. Some animated videos feature 2D or 3D characters with text-to-speech voices, while others employ human voices for narration. 2D videos are typically presented on a flat plane, whereas 3D videos incorporate dimensions and depth into their design. A form of animation that has endured over the years and is nearly prepared in a manner akin to the arranged images mentioned in the preceding paragraph is referred to as stop-motion animation. Stop-motion animation is a technique where the movement of objects is recorded frame by frame to tell a story to viewers (MasterClass, 2021). This method, also referred to as stop-frame animation, involves capturing individual frames while physically adjusting objects between each frame. When these images are played back quickly in sequence, they create the illusion of motion. The videos utilised in my study are live-action videos instead of animated ones. It is worth noting that animated videos offer certain advantages over live-action videos since they do not require a film crew or actors for their production.

Another favourable perspective on animated videos is provided by Smith et al. (2012) in a study that examined the effectiveness of computer animation vignettes compared to live-action videos in classroom behaviour scenarios. The findings suggested that computer animation technology could offer students more significant advantages than live-action videos featuring staged actors. However, for my study, live-action videos were chosen primarily because of the need for more skilled personnel in animation design. In the live-action videos, two characters, myself and a Grade 4 science teacher, donned mascot costumes to emulate cartoon characters. In a humorous manner, we acted out and modelled the subject matter to the students who served as the observers.

To clarify the terminology used in this study, I see it essential to address the distinction between comics and cartoons, as there could be confusion surrounding these terms, particularly the term "video-mode comics" for live-action videos (Khan, 2021). While these terms are sometimes used interchangeably, some literature sources distinguish them. According to Khan (2021), a cartoon is defined as an animated visual format accompanied by sound, while a comic is described as a written, printed format in either black and white or colour. Considering this definition of a comic, it may initially seem inappropriate to refer to a video as a comic. However, the exact definition that seeks to differentiate comics from cartoons acknowledges that a cartoon is an animated visual.

It is important to note that the videos used in this study do not fall under the category of animated visuals, which is why they cannot be accurately labelled as cartoons. If we were to call them "videos" or "films'', it would not fully capture their unique nature. These videos were intentionally designed to incorporate humour, making the learning experience enjoyable for students. In accordance with Webster's New World Dictionary, the term "comic," derived from "comicus" in Latin and "Komicos" in Greek, is an adjective used to describe something related to comedy, humour, or amusement (Harcourt, 2010). Therefore, it is fitting to refer to these videos as "video-mode comics" because they are designed to be both amusing and educational, aligning with the humorous and entertaining aspects of comics. This clarification is essential as it will enable teachers and fellow educators to grasp the specific meaning and context of "video-mode comics" used in this study.

When teachers and fellow educators have a solid understanding of the various types of comics and their constituent elements, it becomes more feasible for them to become acquainted with using comics as a medium for teaching and learning. This knowledge facilitates their development of comic literacy. It enables them to better relate their experiences concerning the effectiveness and limitations of comics when they have a clear grasp of the subject matter. In the subsequent sub-section, I delve into the characteristics that should be taken into account when creating comics for science education.

3.2.3 Characteristics of comics in science education

As per Akcanca (2020), three critical characteristics of comics hold significance in science education: humour, visualisation, and contextualised learning. The element of humour in comics puts science students at ease and alleviates the potential stress associated with grappling with complex scientific concepts. In alignment with Akcanca (2020), Ozdemir (2017) expounds that humour fosters a stress-free learning environment, enhances student engagement, and contributes positively to the comprehension of scientific concepts. In contrast to these positive effects of humour, Gorham and Christophel (1990) point out that no direct correlation is recorded between humour and retention. This information implies that incorporating humour in the classroom does not automatically lead to improved material retention. However, since humour is an arousal agent, it may indirectly impact retention by increasing students' attention. Consequently, Ozdemir (2017) contends that the heightened attention resulting from humour may, in turn, enhance content retention.

The second essential characteristic of science comics is visualised learning, which becomes achievable when students possess visual literacy skills (McVicker, 2018). Visualised learning implies that students can read, write, and effectively comprehend subject matter through visual means, which aligns with the contemporary prevalence of digital content in today's world compared to previous centuries. McVicker (2018) regards visualised learning as a dimension akin to language arts standards and a fundamental element for grasping the essence of comics.

Contextualised learning, as explained by De Jong, Specht, and Koper (2008), is another pivotal aspect. It aids students in connecting what they learn in the classroom with real-world events and occurrences. Contextualised learning stimulates students' interest in their studies and enhances their comprehension of the content, fostering the development of critical thinking skills.

Comprehending these characteristics of comics in science education is instrumental in gaining a deeper understanding of comics and improving their implementation. Consequently, in the following sub-section, I delve into the utilisation of comics as a teaching and learning medium after exploring the essence and composition of comics.

3.2.4 The use of comics as teaching and learning media

A comprehensive examination of the literature concerning various types of comics and their constituent elements has laid the groundwork for a thorough exploration of the utilisation of comics in the educational setting. Comics are particularly well-suited for facilitating the teaching and learning of science due to their inherently self-explanatory nature, surpassing many other instructional tools (Syslak, 2020). In most of the studies, they are found to have a statistically significant effect on learning outcomes. Al-Rabaani and Al-Aamri (2017) conducted a study to examine the impact of cartoons on enhancing water-related awareness and shaping attitudes toward cartoon-based instruction in Omani Grade 4 students within the context of social studies. Their research revealed statistically significant differences in performance between the experimental and control groups, favouring the experimental group. Additionally, Al-Rabaani and Al-Aamri (2017) assert that students exhibited highly positive attitudes regarding the use of comics in social studies lessons and a favourable stance toward educators utilising comics as an instructional tool.

These findings align with other studies, such as those conducted by Marianthi et al. (2008), Hosler and Boomer (2011), and Trnova et al. (2013), all of which similarly discovered that students held positive opinions regarding the efficacy of comics as a teaching approach. Moreover, these studies consistently demonstrated that comics could effectively address misconceptions across various subjects and enhance students' academic performance. In conclusion, comic instruction emerges as an effective means of fostering positive attitudes and views among students, thereby contributing to their overall academic excellence.

The effectiveness of utilising comics in education has been reaffirmed by a year-long project study involving pre-literacy children (Koutnikova, 2017). This project provided substantial evidence supporting the use of comics as a contemporary and highly efficient pedagogical approach, particularly in the context of teaching Natural Studies. Additionally, Dalacosta et al. (2009) evaluated comic-based instruction to enhance the teaching and comprehension of science concepts. Their findings demonstrated that video-mode comics significantly improved students' knowledge and comprehension of science concepts in primary school settings. The improved

student's knowledge and comprehension are especially significant because science concepts often pose challenges for educators regarding effective conveyance and ensuring students grasp the concepts with certainty.

In the context of book-mode comics, a study by Jang and Park (2014) illuminates the symbiotic relationship between reading book-mode comics and enhancing creativity. Their research posits that reading book-mode comics fosters creativity significantly, surpassing the creative benefits of studying texts in isolation. Moreover, Da Silva et al. (2017) contend that book-mode comics are pivotal in cultivating reflective practice within a learning environment and nurturing creativity.

Given comics' potential to promote creativity, they serve as valuable tools across diverse classroom settings to enhance students' academic performance. Beyond the Science classroom, Panjaitan, Lijana, and Wahyuni (2019) assert that comics are both feasible and suitable for teaching Ecology. Notably, comics have demonstrated effectiveness not only in Ecology but also in subjects such as Mathematics, English, and Social Studies (Rokhayani & Utari, 2014; Firsty Nur Fadhila & Widodo, 2019; Soewardini et al., 2019; Usodo, 2019; Harahap & Bukit, 2020). However, their unique potential is especially pronounced in the Science classroom, where the abstract nature of scientific content often challenges sustaining students' interest.

Spiegel et al. (2013) emphasise that comics possess the potential to captivate students who may not have previously harboured an interest in science education. Their study also underscores that when science content is presented in a comic format, it piques students' curiosity and is a motivational tool (Spiegel et al., 2013). This assertion about the motivating influence of comics on students in a Science classroom is corroborated by Syarah et al. (2019) and Rahayu et al. (2021). These researchers reveal that students exhibit motivation and active engagement during comic instruction due to its interactive nature, which enables them to relate the learning experience to real-life situations and experiences. Moreover, Syarah et al. (2019) contend that comics inspire educational engagement in early school years (ages 5-8), which serve as a foundational stage in preparing students for Grade 4, where they are expected to thoroughly engage with the subject matter.

In their study on using comics within instructional design to enhance cybersecurity, Zhang-Kennedy et al. (2016) observed that comics played a pivotal role in enhancing comprehension and fostering positive changes in security management behaviour. Notably, security personnel encountered challenges in adhering to daily security protocols, primarily stemming from a limited understanding of security threats. In response to this issue, Zhang-Kennedy et al. (2016) proposed the implementation of online interactive comics as a means to ameliorate the situation. These comics effectively directed users' attention and facilitated a deeper understanding of security matters. Consequently, integrating comics into the classroom can enhance student engagement during teaching and learning. This assertion is substantiated by Lin et al. (2015) and Nashir et al. (2021), who contend that teacher-inspired comics establish effective communication channels that promote active student engagement within the classroom. Thus, the demonstrated efficacy of comics in motivating students to engage with the subject matter positions comics as a valuable tool for addressing the challenges encountered by teachers in the Grade 4 Science classroom.

In addition to fostering engagement and motivation, Lee and Kim (2015) observed that comics can also facilitate the development of self-study methods and effective reading guidance plans. Regarding students' reading behaviour, Lakshmi (2017) analysed the effectiveness of the Lexical Approach to Language Teaching, which is based on principles related to word understanding and word combinations (chunks). Lakshmi (2017) further noted that authentic texts such as comics provide a rich source of various lexical fragments.

Furthermore, the study conducted by Maryani et al. (2019) examined the impact of using comics without the text in media and direct learning on the early knowledge and narrative writing skills of fourth-grade elementary school students. Their research highlighted the effectiveness of comics in improving narrative writing skills. Maryani et al. (2019) confirmed that students in the experimental class who utilised comics media without text exhibited higher levels of narrative writing skills and initial knowledge than those in the control class who received direct instruction.

Comics have also demonstrated their utility as an alternative and effective tool for assessing students' knowledge and skills in the Science classroom, as supported by research conducted by

Perales-Pelacios and Vilchez-Gonzalez (2005), Song et al. (2008) and Naylor & Keogh (2013). Similarly, Chin and Teou (2009) explored the use of concept cartoons as a formative assessment tool, emphasising that such assessments consider students' conceptual and epistemic thinking. Beyond formative assessment, the efficacy of comics is observed in practical activities, with Affeldt and Eilks (2018) highlighting their potential to enhance student motivation and situational interest.

However, despite the positive effects of using comics, some researchers have expressed concerns regarding their content and impact on children's education (Kachorsky, 2022). Critics argue that comics lack literary merit, may have a negative psychological influence on children through violent representations, and contribute to a decline in interest in traditional reading (Kachorsky, 2022). Others have viewed comics as obstacles to literacy, suggesting that they can negatively affect reading comprehension and cause eyestrain (Yang, 2003). In fact, Yang (2003) noted that comics were vilified as a threat to other forms of reading media, leading some scholars to advocate for their elimination as an educational tool. In the late 1940s, psychiatrist Fredric Wertham even warned the American government about the perceived dangers of comics when used by children, citing concerns about violence, racial stereotypes, and illiteracy as negative aspects (Yang, 2003). These accusations led to the removal of comics from classrooms and a halt in scholarship related to comic instruction (Yang, 2003).

To counter the vilification of comics, particularly the critical suppression led by Wertham, passionate comic fans have voiced their strong opposition, expressing their disdain for him and blaming him for nearly causing the collapse of the comic book industry in the 1950s. As Beaty (2005) notes, the legend of Wertham's influence is pervasive among comic enthusiasts and is passed down like a tribal myth. The resurgence of comics in the public eye came about as scholars began to challenge the credibility of Wertham's data collection methodology, as highlighted by Beaty (2005). In line with Beaty's perspective, Yu (2016) revealed that Wertham was widely criticised for relying on his personal opinions rather than following proper research protocols. Wertham had labelled comics as a distraction responsible for diverting students away from more respected forms of literature and impeding their acquisition of essential literacy skills (Yu, 2016).

It is worth noting that Wertham's critique encompassed all comics, describing them as vulgar, ungrammatical, poorly drawn, and cheaply printed (Yu, 2016).

Regarding the challenges teachers face when using comics, Muyassaroh et al. (2019) identify some common difficulties. These include the teachers' inability to draw comics (Muyassaroh et al., 2019). While the inability to draw is often cited as a significant challenge, it is worth noting that various software packages are available to assist teachers in creating comics. Artigliere (2016), Meyers (2014), and Shively (2011) recommend using comics creator software such as Comic Life, Pixton, and Ink-Do for this purpose. However, it is essential to acknowledge that some teachers may still need help integrating comics into their teaching practices due to concerns about time constraints. They may perceive the need for more rigorous academic activities for their students, as opposed to what they may consider frivolous activities involving comics, as noted by Morrison et al. (2002).

Moreover, Avarogullari and Mutlu (2019) and Akcanca (2021) have highlighted challenges associated with comic instruction, including difficulty aligning text with images, insufficient experience with comics, and a need for access to technological devices. Trnova et al. (2013) and McVicker (2018) have also identified negative aspects of comics in education. They point out that teaching and learning with comic instruction can pose challenges when students need visual literacy skills and the interdisciplinary competencies necessary to interpret comics effectively. To compound matters, Grade 4 students are not just struggling with visual literacy but are also facing general literacy challenges. Zimmerman (2014) substantiated this issue by highlighting a literacy development challenge experienced by South African students at the Grade 4 level. This evidence, drawn from the Progress in International Reading Literacy Study (PIRLS) conducted in the year 2000, highlights the presence of reading comprehension difficulties that may contribute to their poor academic performance. From a different perspective, Sari asserts that comics can serve as a tool to capture students' attention and enhance their understanding of specific topics. However, it should be noted that this does not imply that comics can replace the vital role of the teacher or lecturer in the classroom (2018).

The debate regarding whether comics and other technology-driven tools can substitute teachers in the classroom is a topic of interest. Irshad (2022) cited Nik Kowdley, a Grade 5 teacher at Maddison Trust Elementary School in Virginia, United States, who weighed in on this question. Kowdley emphasised that computer-related technologies can never replicate the nurturing and supportive environment that teachers provide. Unlike computers, teachers can establish personal connections with each student, understand their unique needs, and promptly address them. Students can freely seek clarification and ask questions on topics they find challenging, and teachers are there to assist them in a personalised manner.

Moreover, many individuals choose a career in teaching because they were inspired by their teachers during their student years, an inspirational aspect that computer-related technologies cannot replicate (Vanbaren, 2018; Irshad, 2022). Dejanovic (2021) highlights the significance of using technology in moderation within the classroom. While modern technologies, including comics, can serve as valuable tools, they should be viewed as mediators that complement the teacher-student relationship, as nothing can replace the personal and warm connection that teachers offer in the classroom. Vanbaren (2018) also emphasises that it is the teacher who typically addresses and reports student misbehaviour to authorities or parents, underscoring the irreplaceable role of teachers in classroom management. Therefore, despite the pedagogical success of comics in the classroom, they are regarded as tools that assist teachers rather than substitutes for teachers themselves (Dejanovic, 2021).

In conclusion, the reviewed literature has demonstrated that comics in teaching and learning can have several positive effects, including enhancing subject understanding, promoting cognitive development, fostering creativity, improving learning outcomes, encouraging self-directed study, and motivating students. However, challenges and limitations exist when employing comic instruction in classrooms. Despite the historical concerns associated with comics, it becomes evident that the artistic components that form the foundation of comics are valuable in teaching and learning science. These components underscore the importance of incorporating art into STEM subjects, leading to the emergence of STEAM (Science, Technology, Engineering, Arts, and Mathematics) as a holistic educational approach.

3.2.5 Art and Science (STEAM)

Traditionally, art was often perceived as a supplementary skill rather than an essential competency, while science held a central role in preparing individuals for the future (Eisner & Powell, 2002). However, Eisner and Powell (2002) argue that these subjects were inherently complementary, with art addressing emotional aspects and science addressing the pursuit of factual knowledge. In a world where nations strive to foster innovation as a driving force for development, a new educational paradigm, STEAM education, has emerged and gained global socioeconomic significance (Setiawan & Saputri, 2019). STEAM, which stands for Science, Technology, Engineering, Arts, and Mathematics, has supplanted STEM (Science, Technology, Engineering, and Mathematics) as it recognises the importance of integrating the arts into science and technology fields, which were previously devoid of the artistic concepts and practices necessary for a comprehensive education (Setiawan & Saputri, 2019).

Barks (2020) asserts that the arts and sciences rely on fundamental creative practices such as imagination, construction, and reflection. Barks argues that STEAM education has provided a new platform that emphasises helping students make sense of scientific phenomena, moving away from the traditional approach of rote learning scientific facts. Therefore, Soroko et al. (2020) stress the importance of implementing STEAM in education, as it motivates students and nurtures their creative thinking abilities, exposing them to Information, Communication, and Technology (ICT) and various art forms while learning science. Perignat and Katz-Bvonincontro (2019) also concur with Soroko et al. (2020) that STEAM education enhances students' creativity and thinking skills, which are essential for effective science learning.

In addition to enhancing creativity and thinking skills, Setiawani and Saputri (2019) have highlighted that STEAM education also enriches students' emotional and spiritual aspects, potentially leading to academic excellence and overall personal growth. These positive attributes associated with STEAM affirm that the integration of creativity in teaching and learning, particularly the incorporation of art in science education, equips students with the skills and competencies needed for success in the era of the Fourth Industrial Revolution (IR4.0) (Shatunova

et al., 2019). Therefore, as emphasised by Kim et al. (2019), STEAM education is considered a practical approach to addressing the diverse needs of students in the classroom.

When examining the formulation and definition of STEAM, it becomes evident that achieving STEAM goals can be closely aligned with using comics and vice versa. Schools that incorporate comic instruction into their classrooms are more likely to achieve STEAM's objectives than those that do not (Shatunova et al., 2019). Teaching science through comics involves integrating art into science education, a fundamental component of STEAM. Both STEAM and comics have the potential to enhance students' creativity and critical thinking abilities, which can help address the challenges students face in understanding complex science concepts (Shatunova et al., 2019).

However, it is essential to recognise that students at different stages of development and grade levels have varying needs and interests. Therefore, it is crucial to implement STEAM principles through comic instruction while considering the age of the students. Consulting Piaget's learning theory of cognitive development can provide valuable guidance for effectively matching the age of the students with the characters and content of the comics to ensure successful implementation.

3.2.6 Cognitive Development and Learning Science

In the context of implementing STEAM education, it is crucial to recognise that understanding students' cognitive development, thinking capacities, and cultural contexts is essential. This consideration draws upon the theories of cognitive development proposed by Piaget and Vygotsky.

In the previous century, Jean Piaget delineated a cognitive development theory consisting of four stages: sensorimotor, preoperative, concrete operational, and formal operational stages (Babakr et al., 2019). In the context of my study, I focused on the concrete operational stage, which encompasses children aged between seven and eleven years. According to Huitt and Hummel (2003), the concrete operational stage is particularly relevant during elementary and early adolescence. At this stage, intelligence is demonstrated through logical and systematic manipulation of symbols, known as operational thinking. Huitt and Hummel also note that many

primary education programs are designed based on Piaget's theory, emphasising discovery-based learning (2003). Students learn best when teachers support their interests and challenge their abilities within the scope of their developmental stage. Therefore, effective learning models for students at this stage should align with these principles. Damopolii and Rahman (2019) advocate for the Student Teams-Achievement Model (STAD) and science comics as a combination of learning models and innovative teaching tools to enhance cognitive student achievement. This perspective is also supported by Jee and Anggoro, who emphasise the positive impact of learning science through models like comics on coherent cognitive development (2012).

Furthermore, Ghazi and Ullah (2015) state that students within the concrete operational stage of Piaget's theory generally possess the ability to solve science problems, with urban students often outperforming their rural counterparts. This performance disparity is attributed to differing sociocultural environments, such as varying access to technology and resources. My study examined the effects of video-mode and book-mode comics in science classrooms across two different environments and instructional mediums. I compared two primary schools in a town setting to two in a rural village setting. The study aimed to assess how external factors, including sociocultural environments and instructional mediums, affect students' acquisition of science concepts at the same cognitive developmental stage. Understanding these external factors' impact aligns with Vygotsky's Zone of Proximal Development (ZPD) theory of cognitive development, as discussed in Sub-sections 2.3.3 and 2.8.3.

Teachers need the requisite knowledge and skills to effectively implement comics tailored to students' cognitive capacities and cultural backgrounds. Teachers and educators responsible for creating teaching materials can utilise comic software and programs to produce comics suited to students' cognitive developmental stages and where they come from. For successful integration of comics into the educational curriculum, discussions around comic software packages and programs should be conducted with consideration for teachers' needs and preferences.

3.2.7 Comic software and programmes

According to Muyassaroh et al. (2019), the inability of teachers to draw cartoons has posed a challenge to implementing comic instruction in schools. However, this inability should not serve as a barrier, as numerous comic drawing software packages are available for teachers to design cartoons effectively. Artigliere (2016) highlights the utility of Comic Life Creator software in supporting literacy in the classroom. Comic Life has been shown to enhance language development, provide scaffolding, and improve English writing skills for students (Artigliere, 2016). Another software used to create valid, practical, and effective comics is Pixton, often assisted by the Geogebra program in linear programs involving two variables, as demonstrated by Murtikusuma and Hermawan (2019). Meyers (2014) also successfully employed Pixton software to develop comics for Communication Theory.

In addition to these options, several other software packages are available for comic production. For instance, Ink-do is recommended by Shively (2011) as a creative tool for the classroom. Manga Maker ComiPo, Comic Creator Studio, Rebelle 4, Medibang Paint Pro, and Toon Boom Storyboard are valuable software packages for creating comics in the Science classroom. These user-friendly software programs allow users to easily incorporate pages, layouts, backgrounds, and characters in a visually dynamic environment (Inspiration Tuts Editorial, 2021).

Therefore, teachers who may not have the skills to draw cartoons can utilise readily available software packages in the market to create their comics. To facilitate this process, the Ministry of Education and regional directorates could play a role in providing schools with access to these software packages. The successful implementation of comics in education may depend on government and regional support, as schools face financial constraints when it comes to acquiring the necessary resources for comic production, including software packages.

3.2.8 Governmental and regional involvement in comic instruction

Muniran and Yusof (2008) point out that most comics and graphic novels originate from countries such as America, China, and Japan, and many of these comics are not designed for educational purposes or curriculum content. To promote the integration of comic instruction into education,

Muniran and Yusof (2008) recommend that government and regional leadership levels should encourage teachers by organising seminars, workshops, and exhibitions focused on comic instruction. They also suggest that government and private sectors should provide comprehensive support through effective policies and financial resources to advance comic instruction.

Despite the potential of comics as an alternative teaching method, their association with questionable content and pure entertainment may still influence governments' perspectives on their role in education (Heikkinen, 2008). Therefore, it would be beneficial for governments to recognise comics as a form of art deserving of support through policies and budget allocations (Heikkinen, 2008). Government efforts to enhance the production of educational comics are vital for successfully implementing comic instruction in classrooms. Holroyd (2019) corroborates this viewpoint, highlighting the initiatives taken by Asian countries like Singapore, Malaysia, Hong Kong, and Taiwan, where the integration of digital content has been incorporated into national innovation strategies. Consequently, the challenge facing classroom teachers and students regarding comic instruction is for governments to establish programs to make comics readily available for educational purposes.

After conducting a comprehensive review of the literature in the subsections above, it is pertinent to emphasise the strengths of the scholarly literature on comic instruction. Acknowledging these strengths is essential for my study as it enables the exploration of the accomplishments attained by previous comic studies and identifies areas that warrant further investigation.

3.2.9 The strengths of the scholarly literature on comic instruction

The literature reviewed highlights the effectiveness of comics as a prominent tool for teaching and learning. However, it is essential to note that this efficacy is predominantly observed in specific regions of the world. As Figure 3.2 illustrates, the majority of relevant studies originate from Asia, with a significant concentration in Indonesia. So, breaking down the geographical distribution of these studies, 65% are conducted in Indonesia. In comparison, 10% each are attributed to Oman and Korea, with 5% each emanating from India, Greece, Brazil, and the United States of America,

respectively (Marianthi et al., 2008; Hosler & Boomer, 2011; Lee & Kim, 2015; Al-Rabaani & Al-Aamri, 2017; Da Silva et al., 2017; Sari, 2018; Damopolii & Rahman, 2019).

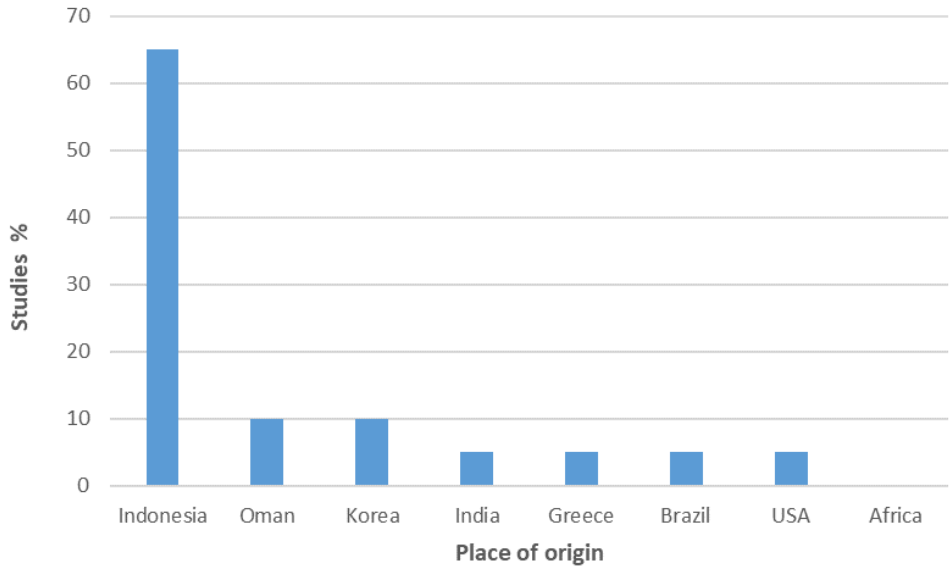


***Figure 3.2**: Geographic sources of the research literature on comic instruction*

In summary, when examining the geographical distribution of these studies, it becomes evident that a significant majority, amounting to 85%, were conducted in Asia, while the remainder were carried out in Europe and the Americas. Indonesia has emerged as a notable contributor to comic studies, possibly owing to its active involvement in educational technology. According to the Cambridge Assessment International Education Census (2018), Indonesian students exhibit high technology utilisation in classrooms, often surpassing even more developed nations. While the findings of these studies may not be universally applicable, this review underscores the profound impact of educational technology on the utilisation of comics in teaching and learning.

Furthermore, the literature has demonstrated the versatility of teaching and learning with comics across various subjects. Figure 3.3 illustrates that 39% of the studies were focused on Languages, 28% on Science, 11% on Mathematics, and 6% spanned across Social Science, Entrepreneurship, Ecology, and undergraduate courses, respectively (Jang & Park, 2014; Rokhayani & Utari, 2014;

Panjaitan et al., 2019; Soewardini et al., 2019). Thus, comics can effectively enhance academic performance in almost every subject and at various educational levels.

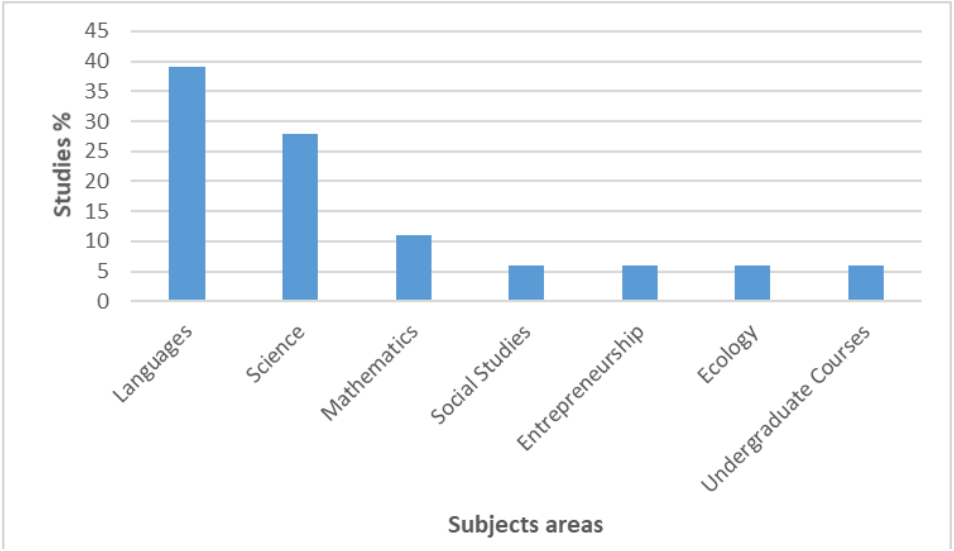


***Figure 3.3**: Percentage of the reviewed literature and subjects*

Finally, it is worth noting that more than half of the reviewed studies relied on quantitative methods for data collection (Hosler & Boomer, 2011; Rokhayani & Utari, 2014; Al-Rabaani & Al-Aamri, 2017; Lakshmi, 2017; Sari, 2018; Damopolii & Rahman, 2019; Firsty Nur Fadhila & Widodo, 2019; Soewardini et al., 2019; Maryani et al., 2019; Syarah et al., 2019; Usodo, 2019; Harahap & Bukit, 2020). Quantitative research findings offer a degree of generalisability, allowing others to independently validate the original data by replicating the analysis (Choy, 2014).

However, despite the strengths identified in the scholarly literature, there were also limitations within the body of literature reviewed for this study. These limitations informed the study's focus on the extent to which the existing literature on comics has covered the topic and what gaps remain to be addressed.

3.2.10 Limitations of the literature

This literature review on the use and effectiveness of comics in teaching and learning has identified five significant weaknesses in existing research on this subject.

Firstly, the existing research on comics in the educational classroom is limited in geographical reach and context. It is advisable to accompany this assertion regarding geographic limitations with the caveat that it relies on the literature that was reviewed and the Google Scholar search engine from which these sources were obtained. The studies were only conducted in Asia, Europe, and the Americas (see Sub-section 3.2.9), inclusive of their high-class classroom contexts (Marianthi et al., 2008; Hosler & Boomer, 2011; Lee & Kim, 2015; Al-Rabaani & Al-Aamri, 2017; Da Silva et al., 2017; Sari, 2018; Damopolii & Rahman, 2019). These are typically classrooms with readily available resources needed to practice educational technology. No related studies were conducted in Africa. In addition, the reviewed literature does not examine contexts of extreme deprivation of resources like the hardware and software required to create comics or to apply them in the classroom and how such circumstances might affect the teaching and learning of science via the medium of educational comics. It is noteworthy that while comic instruction is not widely practised in Africa, comics have been introduced in the past to address critical issues such as HIV/AIDS prevention. Beck (2006) highlights that Kingo and the Sara Communication Initiative comics were utilised in various regions of Africa as campaign tools to tackle HIV/AIDS prevention.

Secondly, the reviewed literature needs to differentiate between video-mode and book-mode comics (Jang & Park, 2014; Rokhayani & Utari, 2014; Panjaitan et al., 2019; Soewardini et al., 2019). This limitation raises questions regarding the comparative effectiveness of video-mode and book-mode comics in teaching and learning. These two forms of comics may have equally significant impacts but yield different results, as one involves visual and auditory elements, while the other combines visual elements with reading.

Thirdly, the reviewed literature needs comprehensive data on the factors that limit the use of comics in classrooms. Despite the positive effects associated with teaching and learning through comics, the literature indicates that comics have not yet been widely adopted as a standard teaching and learning tool (Jee & Anggoro, 2012; Spiegel et al., 2013; Ariyanto & Laksana, 2019; Firsty Nur Fadhila & Widodo, 2019; Muyassaroh et al., 2019). This suggests that the factors hindering the effective implementation of comics as a teaching medium may need to be thoroughly identified or addressed.

Fourthly, the reviewed literature does not explore the effectiveness of comics in teaching science to English as a Second Language (ESL) students, especially those transitioning from their mother tongue to English (Lakshmi, 2017; Maryani et al., 2019; Syarah et al., 2019; Usodo, 2019; Harahap & Bukit, 2020). In many African countries, including Namibia, language policies dictate that students be taught in their mother tongue, mainly from Grade 1 to Grade 3, before transitioning to a foreign language (English) from Grade 4. This transition significantly impacts science subjects due to abstract scientific concepts and complex scientific terminology that students may have yet to encounter in their daily lives. Language barriers are a significant obstacle to learning science for many students (Henderson & Wellington, 1998).

Fifthly, the reviewed literature primarily emphasises comics as a supplementary teaching or learning medium rather than considering their potential to replace the teacher's role in the classroom (Boloudakis & Retalis, 2008; Hosler & Boomer, 2011; Al-Rabaani & Al-Aamri, 2017; Sari, 2018; Marianthi et al., 2019). However, Bandura's Social Learning Theory (1971) suggests that modelling and observation can effectively influence learning, as the observer acquires symbolic representations of modelled activities rather than specific stimulus-response associations.

By addressing the above-highlighted limitations, my study aims to contribute to and extend the existing body of literature on comics in education by filling the gaps left unfilled by previous research on comics.

3.2.11 How my study contributes and extends what we know about comics in education

Firstly, this study aimed to address the geographical limitation of existing research on teaching and learning with comics. It examined the effectiveness of comics as teaching and learning media in 12 classrooms across four primary schools in the Omusati region of Namibia, Africa. Namibia is a developing country where the majority of teachers are computer illiterate, and classrooms often need more equipment for producing or using comics in teaching and learning.

Additionally, the study employed a true experimental design with equivalent groups, encompassing one control group and two experimental groups from each school. Table 3.1

illustrates this design, with 'X' denoting the intervention or treatment, where X_1 represents teaching with book-mode comics, X_2 signifies teaching with video-mode comics, and X_3 corresponds to teaching using the traditional method. 'O' was used to denote the measurements taken during the study. This design allowed for a comprehensive examination of the effectiveness of different comic modes compared to traditional teaching methods.

Table 3.1*: True Experimental with Equivalent Group Design*

Students	Pre-test	Treatment	Post-test
Group A	O	X_1	O
Group B	O	X_2	O
Group C	O	X_3	O

The study aimed to identify challenges affecting the implementation of comics as a teaching and learning medium. For the study to accomplish this, a mixed-method design was employed, which included gathering teachers' perceptions about the use of comics while also measuring their effectiveness. Teachers' feedback could reveal limitations such as a lack of skills, devices for producing comics, availability of book-mode comics in science subjects, difficulties aligning comics with the syllabus, and time constraints in planning comics lessons. Addressing these limitations is crucial for successfully implementing comics in the classroom.

Furthermore, the study sought to introduce comics as a tool to address challenges faced by ESL (English as a Second Language) students at the Grade 4 level, as they are taught Science in English as a medium of instruction for the first time. Comics were seen as a way to mitigate comprehension challenges by connecting abstract scientific concepts in English-medium instruction with the actions of comic characters. Comics were expected to enhance the understanding of abstract scientific concepts for ESL students in Grade 4 Science.

Finally, the study utilised Bandura's Social Learning Theory to develop comics as symbolic representations capable of replacing the teacher's role in the classroom. Book and video comics were used to fully model learning objectives and abstract science concepts within the classroom setting. This approach aimed to enhance the learning experience by providing students with engaging and illustrative representations of scientific concepts.

3.3 Conclusion

This chapter has provided a comprehensive understanding of comics and their role in the classroom, covering aspects such as the types of comics, their elements, their utilisation in the Science classroom, their connection to STEAM, the software and programs used for designing comics, and the importance of governmental and regional involvement for their success.

Additionally, this chapter has emphasised the significance of the study by highlighting its strengths and limitations and explaining how it contributes to the existing body of knowledge and fills gaps left by previous research. Notably, previous studies from the Americas, Europe, and much of Asia have primarily focused on the effectiveness of book-mode comic instruction in the classroom, where comics served as teaching aids to supplement teachers but not as substitutes for classroom instruction. Furthermore, these studies have addressed the challenges associated with understanding abstract science concepts in transitional grades.

However, no prior study has examined how to address the issue of comprehending abstract science concepts in transitional grades, except for suggesting a delay in the transition. Additionally, a related study has yet to be conducted in Africa. Therefore, this research has filled the gap in the existing literature by conducting comic-based instruction experiments in a Namibian classroom, thereby testing both book-mode and video-mode comics on learning outcomes in a transitional Grade 4 classroom within an under-resourced environment. Moreover, it has explored the potential learning effects of direct comic instruction in the absence of a classroom teacher.

CHAPTER 4

Methodology

4.1 Introduction

In this chapter, I outline the methodology employed for investigating the impact of video and book comic instruction on learning outcomes in Science classrooms. I provide a detailed description of how the study was conducted, including the research design, research instruments, data collection procedures for quantitative and qualitative data, population and sampling procedures, data analysis methods, and piloting interview schedules.

Additionally, I discuss the reliability and validity of the pre-and post-tests used in the study, as well as the trustworthiness and credibility of the interview schedules. Ethical considerations that were addressed in the research process are also covered in this chapter. Furthermore, I elaborate on how the book- and video-mode comics were prepared and processed for the study. Finally, I acknowledge the methodological limitations of the research.

4.2 Research design

The study employed a mixed-method research approach with a concurrent nested design. This research design involves collecting both quantitative and qualitative data simultaneously, with one type of data being given more emphasis than the other (Castro et al., 2010). A mixed-method approach was appropriate because it leverages the strengths of both quantitative and qualitative methods while mitigating their individual limitations (Pluye & Hong, 2014). The concurrent nested design is beneficial for gaining insights into underexplored phenomena, as it allows researchers to supplement the primary method with additional perspectives and understanding that may be overlooked when using a single method. This study integrated the qualitative component within a predominantly quantitative framework to provide a more comprehensive view of the research objectives (Castro et al., 2010).

4.2.1 Quantitative methods

4.2.1.1 Overview

The study's quantitative component was addressed through a true-experimental design, which encompassed various randomised pre-test and post-test intervention methods, including an equivalent group design (Handley et al., 2018; Bevans, 2023). In this approach, participants were assessed before and after the interventions, and the test results of the experimental groups were subsequently compared with those of the control group (Wright, 2010). In true experimental designs involving equivalent groups, various participants are subjected to distinct treatments or interventions, and the relative effectiveness of these treatments is evaluated by comparing the performance of participants within the different randomly assigned groups (Reichardt, 2009; Bevans, 2023).

In this study, the quantitative component aimed to investigate the impact of comics, including video-mode and book-mode comics, on the teaching and learning of science. A true experimental design was employed to achieve this aim, which incorporated pre-test and post-test assessments (please refer to Addendum I and J) for both the experimental and control groups. The four schools involved in the study had three groups: two experimental groups designated Groups A and B and one control group labelled Group C. The existing class groups in schools were reassigned randomly to Groups A, B, and C. This random assignment resulted in Group A comprising of Grades 4A, 4B, and 4C students. The distribution worked as follows: the first student from Grade 4A was placed in Group A, the second in Group B, and the third in Group C. This process continued until all students were allocated to their respective groups.

Students in experimental Group A received instruction through book-mode comics, experimental Group B was instructed using video-mode comics, and control Group C received traditional subject teaching, as typically implemented in Namibian schools.

An Analysis of Variance (ANOVA) was conducted to assess the initial comparability of the four groups regarding their essential syllabus competencies at the project's outset. This statistical test aimed to determine if there were statistically significant differences, or lack thereof, among the

groups concerning their average competency levels in the pre-test. Specifically, a three-way analysis of variance (ANOVA) was employed, with school, group, and time as fixed factors and the participant as a random factor.

The impact of the two interventions, video-mode and book-mode comics, was assessed through LSD post hoc tests. These tests involved pairwise comparisons between two means at a time. Specifically, they examined whether there was a statistically significant difference between the average competency level of the two experimental groups and that of the control group in the post-test. Additionally, they assessed whether the two experimental groups had a statistically significant difference in the average competency levels in the post-test. Furthermore, the tests determined if there was a statistically significant difference in the average competency levels of the two experimental groups in the post-test, taking into account the type of school - one with English as the medium of instruction and another with a mother tongue medium of instruction - both located in an urban setting.

In addition to the aforementioned statistical tests, effect size measures were computed to evaluate the practical importance of the results (refer to Section 5.5). Cohen's d was calculated by comparing means, and its value determined whether the observed gains could be considered to have small, medium, or large practical importance, following Cohen's guidelines (1988) as detailed in Section 5.5.

4.2.1.2 Research Instruments

The pre- and post-tests were designed to assess the impact of video- and book-mode comics on science education (examples of these comics can be found in Figure 4.3 and Figure 4.4). The pre-test aimed to gauge students' comprehension of science concepts before receiving instruction through comic-based or traditional teaching methods—conversely, the post-test aimed to evaluate immediate learning outcomes following the interventions.

Both the pre-test and post-test (Addendum I and J) consisted of single-select multiple-choice questions. For each question, students were presented with four answer options and were

required to select the correct response. These assessments encompassed a total of 40 questions drawn from the Grade 4 syllabus for Natural Science and Health Education (NSHE), encompassing content from two themes: "Matter & Environment" and "Energy" (as detailed in Section 4.10).

4.2.1.3 Data collection procedure

Approval to proceed with data collection was granted by the Research Ethics Committee (Social, Behavioural, and Education Research: 21945) at Stellenbosch University in South Africa. Additionally, permission to conduct the research study in the four schools was obtained through the Executive Director's Office of the Ministry of Education, Arts, and Culture in Namibia, facilitated by the Regional Directorate Offices of Education, Arts, and Culture in the Omusati Region. Subsequently, I sought and obtained permission from the school principals, who serve as the gatekeepers of the schools. During this process, I explained the study's purpose and scheduled appointments to establish a convenient timetable for teaching and administering tests.

I devoted a total of five days to conducting the research study at each school. In order to ensure equitable representation, I randomly allocated students into three groups, with a concerted effort to maintain nearly equal gender balance across the groups. Before the teaching interventions, I administered a pre-test to all three groups: Group A received instruction using book-mode comics, Group B received instruction through video-mode comics, and Group C adhered to traditional teaching methods. After completing the pre-test, I conducted three teaching interventions over two consecutive lessons, each of equal duration and at the same time frame (please see Section 4.10 for details).

Subsequently, I administered a post-test immediately after the intervention and collected and recorded the scores obtained from the pre-test and post-test assessments.

4.2.2 Qualitative methods

4.2.2.1 Overview

I framed the qualitative aspect of this research within a qualitative descriptive approach rooted in in-depth interview methodologies. The objective of the qualitative descriptive research approach is to gain insight into the phenomenon's description, as Lambert and Lambert (2012) emphasised.

I chose to utilise in-depth (personal) interviews in this study because they encourage participants to articulate their experiences, attitudes, needs, and ideas pertinent to their organisation, as outlined by Wright (1996). By elaborating further on the in-depth interviews, in-depth interviews are deliberate exchanges in which an investigator endeavours to ascertain the knowledge, experiences, thoughts, emotions, and the significance or meaning associated with a particular topic held by the interviewee. In this dialogue, interviewees share their experiences, opinions, and perceptions, as expounded by Mears (2012).

Within the scope of this study, I delved into the portrayal of comic instruction in the Science classroom, considering various aspects such as student involvement, assessment with comics, practical activities, and other relevant details. During interviews, teachers recounted their observations and interpretations of what transpired in the classroom during comic-based interventions.

4.2.2.2 Research Instruments

The qualitative aspect of the research involved interviews with teachers to explore their experiences with comic instruction and uncover the challenges they encountered when using comics as a teaching tool. Interviews (refer to Addendum M) were the primary method for collecting qualitative data, allowing participants to address specific research questions (Stuckey, 2013).

The interviews consisted of a combination of open and closed questions. Open-ended questions were used to gather detailed information from teachers, while closed-ended questions were

employed to collect biographical data and obtain specific responses, including 'yes' or 'no' answers. Here are examples of some of the questions included in the interviews with teachers:

a) What challenges do you face as a teacher during the preparation of the comics?

b) What are the limitations of using comic instruction in video- and book-mode comics?

c) What are your perceptions of the reasons behind the minimal or no use of comic instruction in Namibian classrooms?

d) How do you address the challenges that affect preparation and teaching with comics?

4.2.2.3 Data collection procedure

Following the approvals and permissions outlined in Sub-section 3.2.1.2, a detailed interview schedule was created, and I conducted interviews with all available Grade 4 Science teachers participating in the research. Before each interview session, I obtained informed consent from the participating teachers. Interview venues were arranged, either in an office or a classroom, depending on the school's facilities. Each interview session was conducted one-on-one, with only the interviewer and interviewee present. With the participating teachers' consent, the interviews were recorded. On average, each interview session with the teachers lasted approximately 45 minutes.

4.3 Population and samples

The population under consideration in this study encompasses all primary government schools in the Omusati Region, totalling 200 primary schools, with three located in urban areas and 190 in rural areas. Given the experimental design of this study, the sampling units are relatively small and were purposefully selected to investigate causal relationships between variables (Babbie, 2010).

For this reason, the purposive sample for this study comprised four schools: two in a rural village and two in a town. This selection exemplifies critical case sampling, a form of purposeful sampling in which a limited number of cases are intentionally chosen for their potential to offer insights applicable to other similar cases (Crossman, 2019).

These four selected schools represent vastly different contexts. The village schools typically serve underprivileged families and face challenges such as overcrowded classrooms, a scarcity of technological resources, and a shortage of highly qualified teachers. In contrast, the town schools primarily cater to students from more privileged backgrounds, with families possessing items like TV sets, computers, and smartphones. These urban schools benefit from well-equipped classrooms and a teaching staff with higher qualifications. Notably, one of the town schools conducts instruction in English, while the other employs the mother tongue as the medium of instruction.

Selecting schools from two vastly different contextual environments was aimed at ensuring that a comprehensive representation of primary schools in the rural Omusati region of Namibia was achieved (refer to Sub-section 4.6.2.2). The choice of the Omusati region was primarily due to its practicality, as it aligns with my duty station and allows for cost-effective travel to the four selected schools. Moreover, the data collected in the Omusati region can be reasonably extrapolated to other regions in Namibia, given the similarities across many regions. The '4 O-regions,' comprising Omusati, Oshana, Ohangwena, and Oshikoto, share a common language, culture, socio-economic conditions, and environmental factors. Additionally, other regions in Namibia feature schools in both rural and urban settings, making them potentially representative of the study's findings.

Based on their class group assignments, I chose a total of 178 fourth-grade students, including both male and female students. Each school was represented by a group of 45 students, with 15 in the experimental Group A, 15 in the experimental Group B, and 15 in control Group C, except for one school, which had 14 students in the experimental Group A, 15 students in the experimental Group B, and 14 students in control Group C, making a total of 43 students for that particular school. Each group consisted of boys and girls of various abilities who were all the same

age. The students were randomly assigned to their respective groups selected from their predetermined class groups. Nine Grade 4 Science teachers from each school participated in the study.

4.4 Data analysis

Quantitative data from this study underwent analysis utilising the Social Sciences Statistical Package (SPSS). SPSS, known for its versatility, accommodates various forms of analysis, including textual, statistical, diagnostic, predictive, and prescriptive, and allows for data transformations such as power, logarithm, and arcsine, rendering it suitable for the objectives of this study (Arkelin, 2014). Specifically, a mixed model ANOVA Type III was employed for the quantitative component of this research.

ANOVA was utilised to scrutinise the data in order to ascertain the impact of the two comic interventions on learning achievement, compare the learning outcomes associated with video-mode and book-mode comic instruction, discern disparities in learning achievement between town schools (Schools S1 and S4), and gauge the effect size on learning attainment for video-mode and book-mode comics.

Qualitative data were analysed through the inductive content analysis method, a process of scrutinising written, verbal, or visually conveyed messages (Elo & Kyngas, 2008). This analysis approach is considered inductive since it deduces the meanings of concepts directly from the data itself (Elo & Kyngas, 2008). Content analysis provides a structured method to systematically capture the underlying connotations in qualitative data by establishing themes through coding, constructing categories, and abstracting findings (Sutton & Austin, 2015). Following the coding and categorisation of data, the content analysis facilitated the emergence of several themes, including experiences with comic instruction, challenges encountered in comic instruction, and strategies for mitigating challenges in a Science classroom using comic instruction.

4.5 Piloting

Piloting is a crucial procedure employed to assess the feasibility and quality of a test or interview protocol while also identifying potential biases on the part of the investigator (Chenail, 2011). During this research phase, the investigator seeks assurance and confirmation that the instruments designed for data collection can effectively fulfil their intended purpose.

Before proceeding with the full implementation of the study, a pilot study was conducted involving pre- and post-tests at School S5. This school exhibits characteristics and a relatively modest environment, closely resembling those of Schools S1, S2, S3, and S4. These modest characteristics and surroundings imply that School S5 is situated in a semi-urban setting. School S5 shares traits with rural schools (similar to Schools S2 and S3) and urban schools (similar to Schools S1 and S4). Consequently, School S5 hosts students from both rural areas, where television sets may be absent in households, and urban-like environments with electricity and Internet access, enabling television viewing.

Through the pilot study, several valuable insights were gained. It was observed that some Grade 4 students needed more confidence in reading, necessitating adjustments to font size, mainly as they encountered difficulties with smaller font sizes. A noteworthy finding was that many students faced challenges when answering questions that presented alternatives (A, B, D, and E) spread across two pages. When options A, B, and C appeared on one page and D on the subsequent page, students tended to disregard option D. This pilot study also emphasised the importance of ensuring that every student attempted all questions, as it was noted that most students in the pilot school did not make attempts on all questions.

4.6 Reliability and Validity of the Pre- and Post-tests

4.6.1 Reliability

Reliability refers to the degree of consistency in measurement results across repeated trials (Bolarinwa, 2016). This study employed alternative-form reliability, also known as Equivalence

reliability. Alternative-form reliability assesses the agreement between two sets of testing measures administered at nearly the same point in time. In this case, the pre-test and post-test each comprised two sections that measured the same competencies or attributes but featured differently worded questions. Given the specific test-retest scenario, reliability was determined by assessing the correlation between the two sections within each measuring instrument. A higher correlation value indicates more significant equivalence and reliability of the sections. A correlation of 0.70, for instance, signifies a reliable item (Bolarinwa, 2016).

In Table 4.1, presented below, the scores for Sections A and B on the pre-test and Sections A and B on the post-test from School S1 (additional scores from School S2, S3, and S4 are available in Addendum B) are displayed. Each section comprises a total of 20 marks. Figure 4.1 illustrates the relationship between the pre-test scores of Section A and Section B.

Table 4.1*: School S1 sectional results of the pre-test and post-test (darker)*

Student code	Section A	Section B	Student code	Section A	Section B
S1A1	13	14	S1A1	14	14
S1A2	7	4	S1A2	6	7
S1A3	14	12	S1A3	14	11
S1A4	11	11	S1A4	12	13
S1A5	6	7	S1A5	12	12
S1A6	12	13	S1A6	14	14
S1A7	17	18	S1A7	19	20
S1A8	12	11	S1A8	10	13
S1A9	13	12	S1A9	16	15
S1A10	8	8	S1A10	14	12
S1A11	10	8	S1A11	13	13
S1A12	10	12	S1A12	17	14
S1A13	11	11	S1A13	15	15
S1A14	8	8	S1A14	11	12
S1A15	14	16	S1A15	17	18

The correlation coefficient can be calculated from the data in Table 4.1 using the formula (=CORREL (Range of Section A, range of Section B)). The calculated correlation coefficient value is r = 0.92, which exceeds the threshold of r = 0.70, as discussed by Bolarinwa (2016). The correlation coefficient results indicate that the pre-test was reliable, given that the coefficient value is more significant than r = 0.70.

Figure 4.2 illustrates the relationship between Sections A and B for the post-test results of School S1. Similar to the pre-test, the correlation coefficient was determined using the data from Table 4.1 and was found to be 0.86. This value also exceeds the threshold of 0.70, affirming the pre-test and post-test reliability.

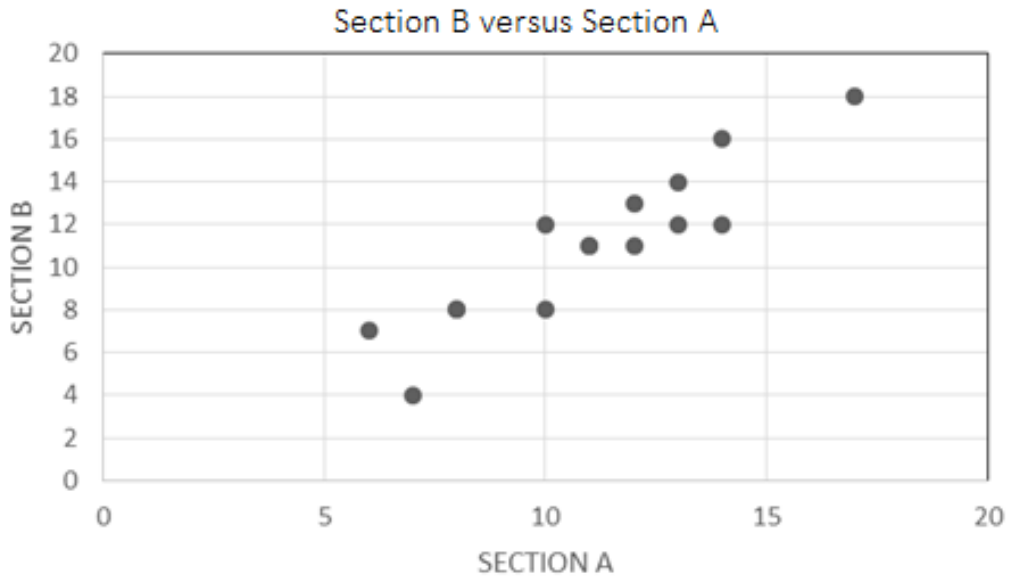


Figure 4.1: The relationship between Sections A and B of the pre-test

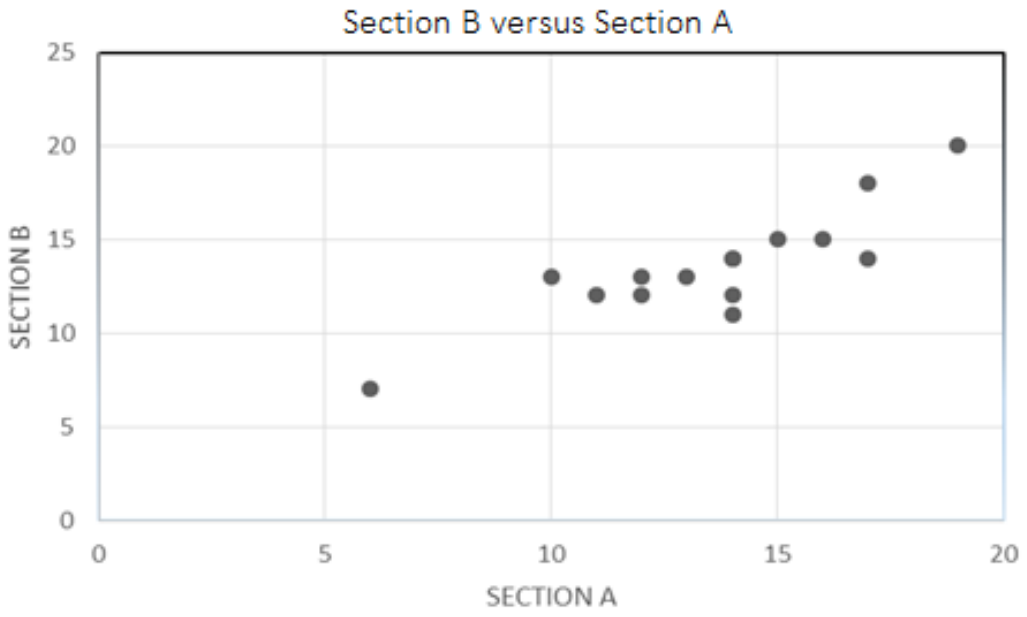


***Figure 4.2**: The relationship between Sections A and B of the post-test*

4.6.2 Validity

Validity assesses the extent to which an instrument effectively measures what it is intended to measure (Patrick, 2011). This study evaluated internal and external validity to determine the validity of the pre-test and post-test assessments.

4.6.2.1 Internal validity

Internal validity is concerned with the accuracy of measures in quantifying the intended constructs (Patrick, 2011). In this study, content validity was utilised to assess internal validity. Content validity involves determining whether the measuring instrument effectively covers the specified content domain by seeking the input of subject experts. Content validity ratio (CVR) is used to gauge the extent of validity in the measuring instrument. The CVR formula (2ng/N)-1 was employed, with "ng" representing the number of subject experts who consider the item to be valid and "N" being the total number of subject experts (Patrick, 2011). A validation team, following Read's (2021) guidelines, assessed the validity of the tests. They considered factors such as whether there is a single correct answer, the correct answer cannot be guessed, the incorrect

options can be chosen by some less proficient students, and whether the content aligns with the Grade 4 syllabus (see Addendum K).

For an item to be deemed valid, when assessed by multiple subject experts, the CVR should be 0.99. In this study, the comic materials and testing instruments achieved a CVR of (2x5/5)-1 = 1, indicating that the measuring tests used were valid. Additionally, internal validity was strengthened by administering the pre- and post-tests simultaneously and minimising the time gap between the tests to ensure consistency.

4.6.2.2 External validity

External validity pertains to the extent to which the findings from the study sample accurately depict the broader reference population from which the study sample was drawn (Patrick, 2011). In this study, the reference population comprises 200 primary schools, encompassing both rural and urban environments. To ensure external validity, I purposely selected two primary schools in a rural village and two in a town setting. This deliberate selection aimed to ensure that the study sample would represent all regional schools in terms of contextual environments. Consequently, the design of this study enhances its generalisability to the entire population of primary schools in the region (see Section 4.3 and 4.11 for further details).

4.7 Validation measures of the video-mode and book-mode comics

Both video and book modes of comics underwent a rigorous prospective validation process, which I designed and illustrated specifically for this study in collaboration with the participating Science teachers (see Addendum L). These teachers provided invaluable guidance and input regarding how the subject matter should be represented and which content should be included in video and book-mode comics. To create the video comics, a Science teacher and I even dressed in mascot costumes to closely follow the content as it appeared in the validated book-mode comics.

The prospective validation process adhered to documented evidence before the implementation of the comics in the instructional lessons, ensuring that the system performed as intended

according to pre-planned protocols. This particular approach was chosen because the use of comics in the study did not commence until all validation activities were completed (O'Keeffe, 2011). A team of five validators, leveraging their subject expertise in alignment with the syllabus, thoroughly assessed and rated the comics prior to their use in the instructional lessons.

4.8 Trustworthiness and credibility of interview schedules

4.8.1 Positionality and truth value

I am a Senior Education Officer (SEO) in the Ministry of Education, Arts and Culture, representing the Omusati Region where this research was conducted. Part of my professional responsibilities as an SEO involves the execution of the curriculum and conducting educational-related research. Additionally, I am involved in developing subject and course curricula and materials in the fields of Physics, Chemistry, and Physical Science.

It is essential to acknowledge that my role as an SEO could influence the outcome of this study. This influence could manifest in various ways, including the data collection process and the interpretation of research findings (Qin, 2016). Therefore, it is crucial for transparency and integrity in research that I provide a clear statement reflecting on the possible impact of my position on the research outcome. By doing so, readers can be informed about this potential influence and make their judgments regarding the validity and credibility of this study (Smith et al., 2021).

It is important to note that while I oversee the implementation of the science curriculum for Grades 8 to 12, typically found in combined and secondary schools in Namibia, this study focuses on Grade 4, which is part of the primary school curriculum. Consequently, the Natural Science and Health Education (NSHE) subject studied in Grade 4 is not within my direct purview and responsibility. I do not have a direct working relationship with the teachers who participated in this research. This distinction positions me as an outsider in the context of this study.

As defined by Smith et al. (2021), an outsider is a visiting investigator who collects data from a research site but does not have an ongoing or direct connection with the participants. Given this outsider status, participants in this study may have felt more at ease and less apprehensive about potential intimidation or bias when participating in the interview schedules. They could draw a clear line between my official work-related visits and those conducted for this research. This clarification is crucial in understanding the dynamic between the researcher and the participants in this study.

Reflexivity is a critical aspect of the research process, and it involves the researcher's awareness of how their experiences, background knowledge, and personal beliefs can potentially influence the research outcome. As England (1994) aptly puts it, researchers do not enter the field as blank slates but carry their perspectives and biases with them. Researchers must be honest and transparent about their positions within the research, as this self-awareness can impact the questions, the researcher's behaviour, and the interpretation of research data.

In my case, it is essential to acknowledge that I have a background as a cartoonist, a personal interest in the arts, and a belief in the power of images. These factors influenced my decision to investigate the effects of comic instruction in Grade 4 Science classrooms. Recognising these influences, I made a concerted effort to maintain objectivity throughout the research process. I aimed to allow the research to unfold organically and draw conclusions based on the data rather than letting my interests or beliefs unduly sway the research direction.

Engaging in this reflexive practice allowed me to mitigate potential biases and ensure the research was conducted with rigour and impartiality. It is a testament to the commitment to conducting credible and unbiased research despite the researcher's background and interests.

4.8.2 Consistency and Neutrality

In order to bolster the credibility and trustworthiness of this qualitative research endeavour, a series of methodological strategies were conscientiously employed, drawing from the insights of Noble and Smith (2015). Attention was diligently directed toward mitigating potential sources of

personal bias that could have exerted an undue influence on the research outcomes. A salient example of this approach pertained to the concealment of intervention group assignments from both participants and the researcher until the implementation phase commenced. This precautionary measure was instated following the identification of a teacher's attempt to revise students on the thematic content under investigation, a situation that could have introduced bias.

Additionally, the study acknowledged the plausible performance disparities among class groups within the same grade level. Informal discussions with educators revealed that specific Grade 4 classes exhibited distinct levels of aptitude, motivation, discipline, and commitment to their academic pursuits. A randomised reshuffling of students across class groups within each Grade 4 cohort was undertaken to curtail potential personal bias among teachers utilising traditional teaching methods. Consequently, the three research groups comprised students selected through a random allocation from the Grade 4 classes in each school. Proactive measures were taken to acknowledge and address biases in the sampling procedures, along with the continued critical reflection on the research methodologies to enhance the transferability of the findings and align the research with the broader scholarly discourse. Notably, the original intention to collect data directly from Grade 4 students regarding the challenges encountered during comic-based learning was re-evaluated and subsequently abandoned. This decision stemmed from concerns that Grade 4 students might need more developmental maturity to provide reliable and generalisable interview responses, owing to their relatively young age and potential language proficiency disparities with their teachers. Instead, teachers were enlisted to furnish insights and data about the students' comic instruction experiences. Furthermore, the research design incorporated a comparative approach by juxtaposing two village schools with two urban schools, aiming to capture diverse perspectives and contextual nuances within the study's purview, thereby bolstering the study's internal consistency and external generalisability, as guided by the principles explained by Noble and Smith (2015).

In pursuit of methodological rigour and research consistency, the study leveraged data triangulation, a strategy explained by Noble and Smith (2015). Data triangulation is instrumental

in research when diverse data collection methods are harnessed to access varying viewpoints, culminating in a holistic and multifaceted set of findings. The research adopted a concurrent nested method, harmoniously integrating qualitative and quantitative approaches to effectuate this triangulation. This methodological synergy ensured that participating teachers were probed for their insights regarding the efficacy of comic-based instructional strategies without foreknowledge of the ensuing test outcomes, thus enhancing the research's comprehensiveness and reinforcing the internal consistency of the study's findings.

4.9 Circumventing Hawthorne Effect

Brannigan and Zwerman (2001) explain that the Hawthorne Effect is a phenomenon in social science research wherein individuals adjust their behaviour or performance when they become aware that they are under observation or are part of a study. This effect underscores the need to consider the influence of participant awareness and reactivity in research settings, as it can introduce a confounding variable that can impact research outcomes. Consequently, researchers must exercise caution when designing and interpreting experiments or studies involving human subjects.

In the context of this study, efforts were made to mitigate the Hawthorne Effect by ensuring that students remained unaware of the research process. After completing the pre-test, students were kept uninformed about the subsequent steps in the study. Similarly, after the intervention, they were not informed about the possibility of a post-test. Additionally, it is essential to note that students in Grade 4 typically need more understanding of experimental approaches, making it unlikely for them to anticipate future developments.

A similar approach was adopted in the qualitative strand of the study. The awareness of teachers regarding the research proceedings did not influence the study's outcomes, as it was not centred around them. They were neither observed nor subjected to testing. Instead, teachers were asked to reflect on their experiences and observations within the classroom, which was done before

their exposure to the test results. This strategy helped maintain the integrity of the study by minimising the potential impact of the Hawthorne Effect on both student and teacher participants.

4.10 Ethical Considerations

4.10.1 Consent, Assent, Confidentiality, and Anonymity

After obtaining ethical clearance and the necessary permits (please refer to Addendum N and O), all participants were required to sign a consent form clearly stating their right to withdraw from the study at any point (see Addendum H). The participants in this context primarily refer to the teachers who engaged in interview sessions and participated in comic production. For the underage participants, precisely Grade 4 students in both experimental and control groups, consent forms were signed by their parents or legal guardians (see Addendum F and G). Furthermore, alongside obtaining consent, students were also asked for their assent, as it is generally expected that Grade 4 students possess a sufficient understanding of research objectives (see Addendum E). Pseudonyms were assigned to them to ensure the anonymity and confidentiality of each participant and participating school (David & Resnik, 2011).

4.10.2 Safety of data and research benefits

The raw data have been securely stored in a locked file cabinet, and electronic records have been safeguarded within a password-protected computer, with a retention period of at least five years before permanent deletion. Test results and interview sheets have been appropriately disposed of through incineration, and electronic data has been irreversibly deleted using a secure shredder. Participants were provided with the assurance that the information obtained from them would be used exclusively for research purposes and treated with the utmost confidentiality.

Groups A and B of participating students directly benefited from this research as it enhanced their comprehension of scientific concepts, positively affecting their academic achievement. However, students in the active control group were not exposed to the potential benefits of participating in instruction enriched with comics, which could lead to improved learning outcomes in science

subjects. Consequently, it is recommended that teachers consider extending this instructional approach to benefit these students after the conclusion of the study.

Furthermore, it is imperative to disseminate information within society regarding the significance of comics in science education. Educational inspectors and Senior Education Officers within the Ministry of Education should be provided with guidance on how to support teachers in implementing comic-based instruction to facilitate a better understanding of scientific concepts among students. Additionally, this study can serve as a catalyst for educational material developers to explore the incorporation of comics for educational purposes. Lastly, I have committed to all ethical considerations outlined in the Stellenbosch University Data Policy.

4.11 Preparation and the process of book-mode and video-mode comics

For the commencement of the study, a selection of suitable topics and essential competencies was made from the syllabus (see Table 4.2). A group of Grade 4 Science teachers was engaged in discussions concerning the optimal content presentation methods. Subsequently, the creation of a book-mode comic commenced, with the active involvement and contributions of the Grade 4 Science teachers who also partook in the interview sessions. These teachers collectively played a significant role in formulating the content that was subsequently integrated into the speech bubbles of the comic illustrations. These comics, which were collaboratively developed, served as the foundation for creating book-mode comics.

Table 4.2 outlines a selection of essential competencies extracted from 4 sub-topics of the NSHE syllabus as an example. In reality, the comics utilised in this study encompassed nine topics. These topics were chosen in accordance with the regional year plan, which prescribes the specific content to be taught and the corresponding timing for instruction. No particular preference or selection criteria were employed for choosing topics suitable for comic-based instruction. It was deemed that all topics within the curriculum could be effectively incorporated and taught using comics as a medium. Upon reviewing this section of the syllabus, it became evident that explaining abstract concepts such as heat, light, and sound to Grade 4 students might pose a challenge. These

concepts necessitate a conceptual shift from the tangible realm of matter to the intangible domain of non-matter, demanding practical cognitive imagination for broad comprehension. Clarifying that one can physically sense heat and light, which is visible but lacks material substance, may prove challenging for students to grasp. Consequently, a series of comic strips were created and organised in alignment with these subtopics of the syllabus, contributing to the formation of the comic book.

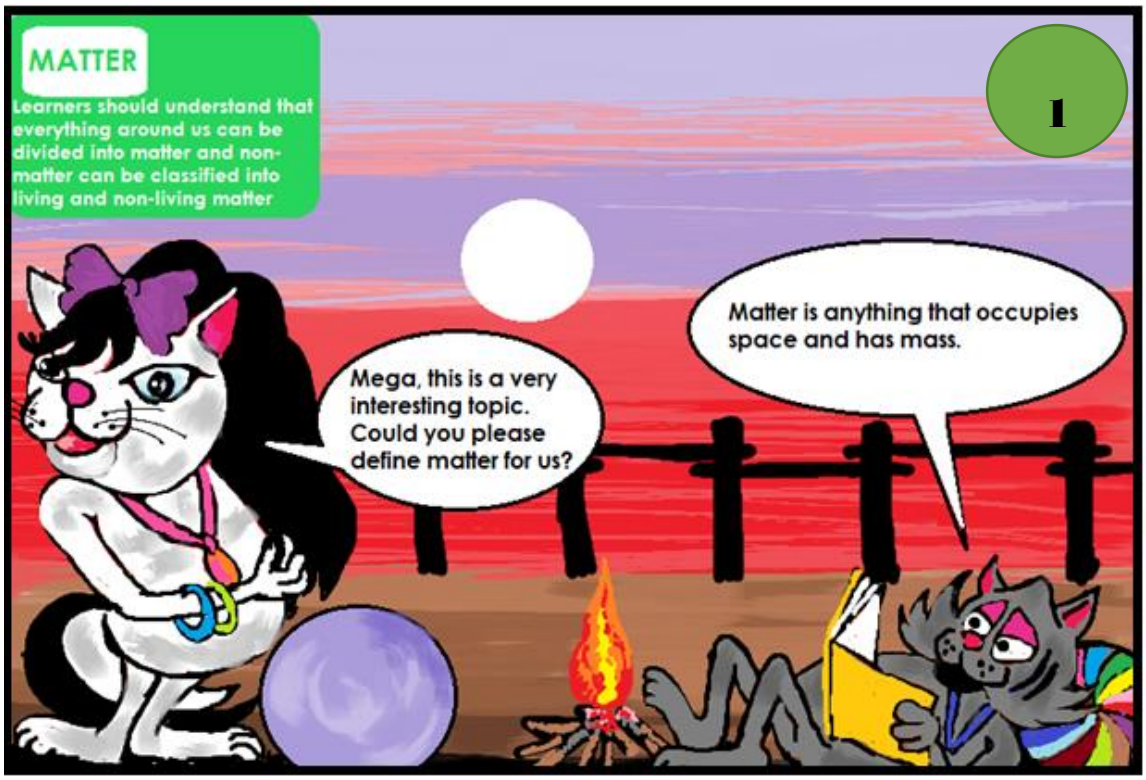
Following the compilation of these comic strips, a pilot test was conducted in a primary school (S5), which was not included as part of the main study. Feedback and suggestions from this piloting phase were implemented to refine and enhance the content. After the requisite adjustments were made and the expert validation was completed, the comic book material was deemed suitable for intervention in primary school.

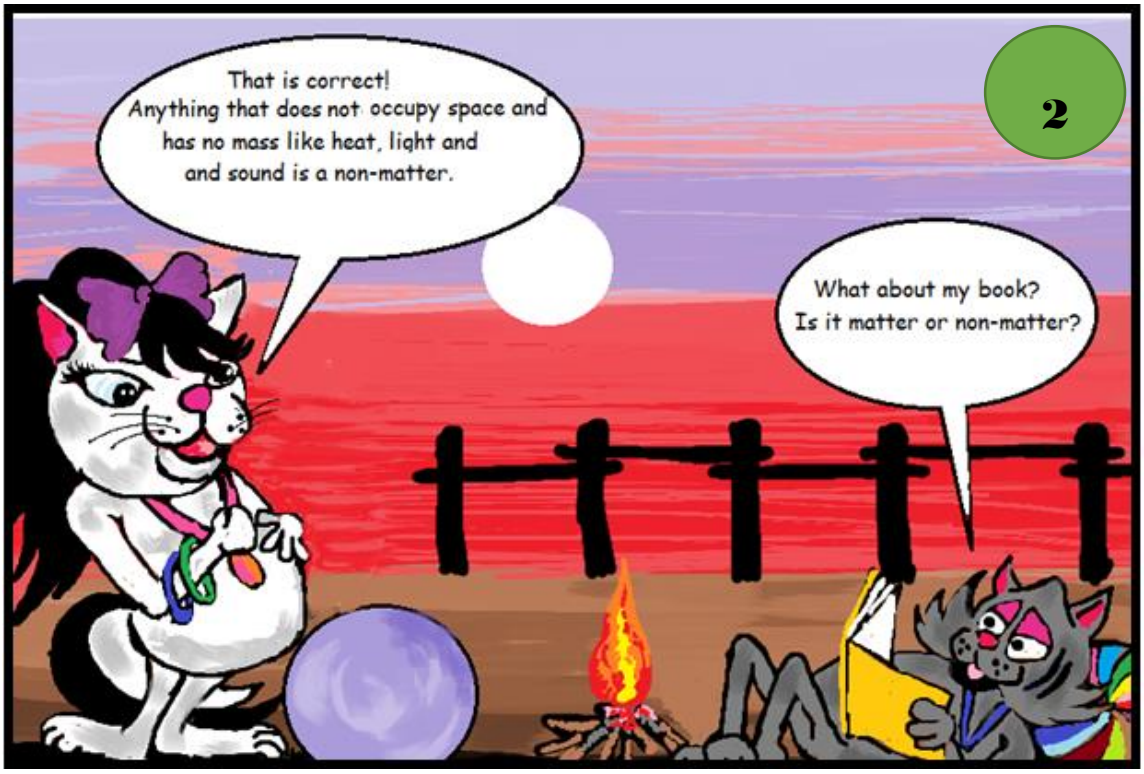
A Grade 4 primary Science teacher, who was not involved in the interview sessions and did not take part in the actual production of the comics, was provided an opportunity to review the book-mode comics. In the video adaptations, the teacher assumed the role of the character Muna, while the researcher (myself) portrayed the character Mega (Figure 4.5). It is noteworthy that Muna represented a female character, whereas Mega was depicted as a male character.

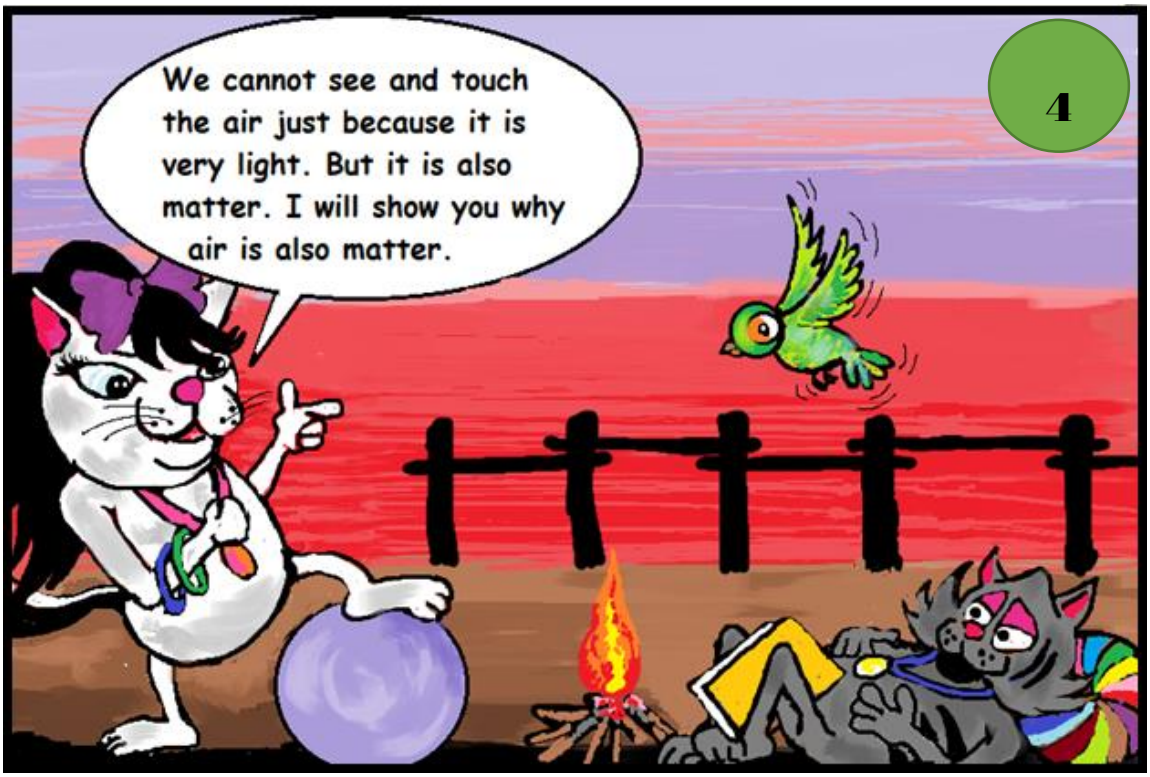
The video-mode comics did not undergo a separate piloting phase since they adhered to the same script as the book-mode comics. As a result, it was inferred that if the book-mode comics were validated and found effective, the video-mode counterparts could be regarded similarly in terms of their potential efficacy.

Table 4.2: *Part of Grade 4 Natural Science and Health Education Syllabus*

TOPIC 3 MATTER & ENVIRONMENT	
3.1 Ecosystems	
• know different ecosystems and be aware of their importance for human existence	• identify the different ecosystems from diagrams • describe characteristics of marine, desert and savannah ecosystems • identify examples of human activity that has beneficial or harmful effects on the environment (e.g. deforestation) •
3.2 Types of soils found in Namibia	
• know different types of soils in their local environment and realise that plants grow differently in these soils	• investigate and report on different types of soils in their local environment • compare the similarities and differences of these soils (loam, clay and sand) in terms of colour • investigate and report how plants grow in these soils
3.3 Matter	
• understand that everything around us can be divided into matter and non-matter and that matter can be classified into living and non-living matter	• define the term matter • outline the difference between matter and non-matter (for non-matter only restricted to heat, light and sound) • recognise non-matter as a form of energy (with reference to Topic 4) • classify matter into living and non-living groups • differentiate living and non-living matter (differentiation for non-living confined to: “does not move on its own, grow, or reproduce”)
3.4 Identification of states of matter	
• know the three states of matter with reference to water as example	• observe and describe the three states of matter • discuss the different forms in which water exists: solids, liquids, and gases







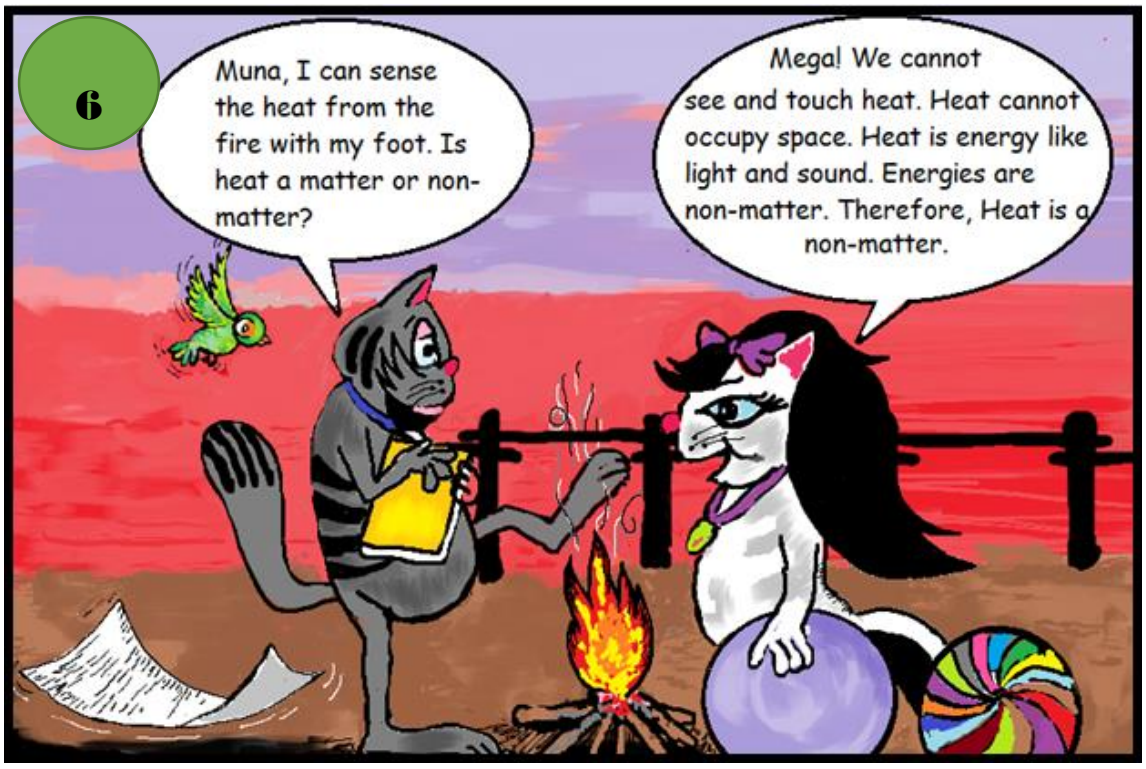


Figure 4.3: *Examples of comic strips (1-8) from a comic book Mega & Muna*

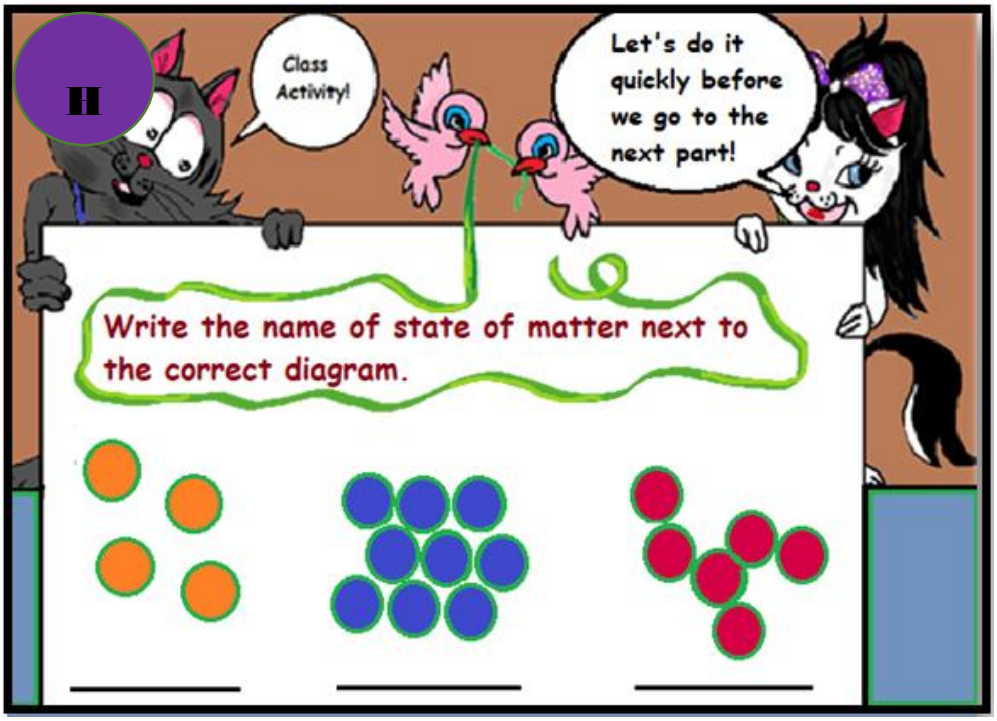


Figure 4.4: *Examples of comic strips (A-H) from a comic book Mega & Muna*

Figure 4.5: *Snapshots from the video-mode comics showing the characters (Muna and Mega)*

In Figure 4.3 and 4.4, I present illustrative character examples drawn from the two comic strips extracted from the comic book of this study. It is important to note that, for the sake of enhanced readability within this document, the dimensions of the comic panels have been enlarged. However, multiple panels are typically condensed onto a single page in the original comic book. The design of the comic content is specifically crafted to encourage students' imaginative engagement as they navigate the narrative alongside the accompanying visual elements. This deliberate approach aims to facilitate the cognitive transition from the familiar to the less familiar—an essential aspect of the process of conceptual change.

The two characters featured in the comics are crafted to function as symbolic representations, aligning with Bandura's theory of modelling. These characters are thoughtfully designed to embody the subject matter, effectively serving as conduits between abstract scientific concepts and the student's cognitive processes. Consequently, the comics serve as a valuable tool for unpacking abstract scientific ideas, empowering students to learn and grasp these concepts by actively engaging their cognitive faculties. The process of conceptualisation of the content presented through comics unfolds effectively within the cognitive realms of the students' minds. The acquisition of knowledge and skills underwent continuous assessment throughout the comic presentation.

The incorporation of assessment is evident through class activities (refer to Panel 8 in Figure 4.3 and Panel H in Figure 4.4) and projects (Figure 4.5), which students must complete before advancing to the next section. While students using book-mode comics have the flexibility to determine their own pace for completing tasks, video-mode comics are different. Video-mode comics are designed with specific timing and include background relaxation music. In line with research by Hallam, Price, and Katsarou (2002) examining the impact of background music on the task performance of primary school pupils, they discovered that soothing music was beneficial for students during task execution. Their study comprised two investigations focused on the influence of calming and relaxing music on arithmetic performance and memory tasks among children aged

10-12. The results revealed that calming music improved performance on both tasks compared to a no-music condition.

On the contrary, music perceived as stimulating, aggressive, and unpleasant had an adverse impact on the children's memory task performance and decreased their reported altruistic behaviour. This aspect was further explored by O'Hare (2011), who provided insights into the beneficial effects of music on students, with a specific focus on differentiating between instrumental and vocal music. The study's findings indicated that instrumental music yields more positive benefits than vocal music, and notably, vocal music negatively impacted academic performance. This explanation implies that the impact of music on task performance is predominantly influenced by emotional arousal and mood rather than exerting a direct effect on cognitive processes. It is important to note that comics were designed for assessment purposes and to facilitate experimental activities.

Panels 5 and 6 illustrate how comics can serve as a model for experimental activities, effectively conveying practical aspects. This ability of comics to depict practical activities is further exemplified in Panels A to E. In instances where students have access to the necessary equipment in the classroom, they can replicate the procedures demonstrated in the comics. This replication enhances learning outcomes and encourages student engagement in the lesson. When students interact with materials and solve problems in groups or pairs, they assume a more self-directed role in their learning, reinforcing the student-centred approach within the classroom. These deliberate design choices aimed to make the comics self-explanatory and capable of substituting for the teacher in the classroom context.

These instructional materials were distributed to the participating schools after the compilation of comic strips to create a comprehensive comic book aligned with the syllabus's essential competencies and the production of video-mode comics. Students were organised into three groups within each school: Group A, utilising the book-mode comics; Group B, engaging with the video-mode comics; and Group C, the control group, instructed through conventional teaching methods.

4.12 The nature and content of the intervention

Students were assigned to groups: Class A for those engaging with book-mode comics, Class B for video-mode comics, and Class C for traditional teaching methods. Each class was equipped with various materials, including balloons, bottles, jars, books, bricks, different types of soils, water containers, animal toys, and atomic models. Once students settled into their respective classes, a teacher was assigned to facilitate the intervention. Notably, students in the book-mode and video-mode comic groups worked independently without direct teacher guidance. In contrast, students in the control group (Class C) received instruction from a teacher using traditional teaching methods. The teacher in Class A distributed the book-mode comics, the teacher in Class B operated the screen, and the teacher in Class C followed the pre-established teaching plan. All participating teachers were permitted to visit all the interventions solely for observation and note-taking without actively participating or interfering with the instructional process.

Students were given pencils and notebooks to jot down any information they deemed important or necessary. The teachers refrained from providing specific directions to the students, not suggesting that they write summaries or actively participate in class activities. Those with comic books were left to read at their own pace. In contrast, students engaged in video-mode and traditional methods received guidance, proceeding at the pace set by the television or the teacher, respectively. Throughout the reading and TV-watching sessions, students maintained a quiet, attentive, and actively engaged demeanour until they completed their respective tasks. After 90 minutes of immersion in the comics or with the teacher utilising traditional methods, students were granted an additional 15 minutes to engage with the materials without explicit instructions. Notably, some students did not linger to complete their reading of the book-mode comics. Most students using book-mode comics finished earlier than their counterparts using other instructional methods. Those who finished ahead of time were given a brief break as needed, affording them the opportunity to attend to necessities such as visiting the bathroom.

After the 90 minutes, all students were instructed to return to their respective groups and put into practice what they had learned. While some students initially displayed hesitancy in engaging with

the materials, upon witnessing their peers experimenting and imitating what they had observed, the remaining students gradually joined in. For students who took an extended amount of time or initially displayed minimal interest in participation, the supervising teacher encouraged them to ensure their inclusion among their peers. Following this, the teachers responsible for the activity asked the students to elucidate their actions and share what they had learned. This process allowed the participating teachers to thoroughly evaluate students' responses to the activities integrated into the comics. Although the students' marks were not officially recorded, this process contributed to shaping the teachers' perspective on the effectiveness of comics in terms of assessment. It was particularly intriguing to observe most students actively imitating actions and behaviours they had encountered in both book-mode and video-mode comics. For instance, students experimented with the materialistic aspects of air, engaged in debates regarding the characteristics of different types of soil (loam, clay, or sand), separated toy animals based on their respective ecosystems, and even attempted to draw conclusions on various concepts independently. However, it is worth emphasising that this capacity for producing or imitating what they observed is most effective when teachers actively provide support and guidance, mainly if students are accustomed to relying on teachers for direction in all their activities rather than being self-directed students.

Both the book-mode and video-mode comics covered content from a total of nine distinct topics. Although it might seem unconventional to address such a broad range of topics within two consecutive 45-minute periods, this approach was deliberately chosen to mitigate the risk of students heavily relying on their preferences for particular topics, whether they were their favourites or the ones they least favoured. This strategy was implemented to prevent potential bias stemming from student preferences from unduly affecting the study's results. Therefore, by exposing students to a diverse selection of topics in a concentrated timeframe, the intention was to minimise the likelihood of individual preferences significantly influencing student performance and, in turn, promote a more well-rounded and balanced learning experience.

The pre-test was administered the previous afternoon before the interventions were scheduled for the following morning to manage time constraints and prevent student fatigue. The post-test, designed to measure learning outcomes after the interventions, was conducted in the afternoon on the same day the students participated in the intervention activities. Students were given a break to rest and recuperate, ensuring they were prepared and in optimal condition for the post-test in the afternoon. This break was necessary to recognise the effort invested during the morning session.

After the students completed the post-test, I gathered all the papers and proceeded to grade them. It was my deliberate choice not to permit the teachers access to the post-test outcomes. The purpose was to keep the test results concealed, ensuring that the teachers would participate in the interviews without prior knowledge of the test results. This approach aimed to prevent the test results from unduly influencing the interview process. By keeping the teachers unaware of the results, I aimed to secure candid and unbiased responses during the interviews without the possibility of their answers being influenced or conflicting with the test results.

4.13 Methodological limitations of the study

The sample of four schools, chosen from among more than 200 primary schools in the region, may raise concerns about its representativeness due to its small size. These schools are situated in diverse urban, semi-urban, and rural environments, each with its unique school culture and classroom practices influenced by their specific contexts. Two primary schools were purposefully selected from a rural village setting, and two were chosen from a town (urban setting), aiming to capture a more diverse representation of the region's educational landscape. This selection was made to address this potential limitation. While the sample size remains modest, this approach ensures a broader contextual perspective and enhances the generalisability of the study's findings (refer to Sub-section 4.6.6.2).

Initially, the plan was to allocate 30 students to each group and enlist the participation of 90 students from each school, resulting in a total of 45 students per group across the schools.

However, the implementation of Covid-19 prevention measures necessitated a modification of the research design. In adherence to the cohort system adopted by schools to mitigate the spread of the virus, classes were divided into halves, with each half attending school on alternate days. Consequently, each school provided only 15 students per group, culminating in 45 students per school.

The initial intention was to incorporate Grade 4 students into the interview schedule to enable them to share their experiences and explain the challenges they encountered while engaging with comics. However, due to their age and developmental stage, it was determined that their inclusion could introduce potential variability in their perceptions and responses. This age-related factor and the varying levels of comprehension among Grade 4 students could potentially undermine the reliability of the study; thus, they were ultimately excluded from the participant sample.

The potential impact of new teaching methods capturing students' attention more effectively than those they are accustomed to is a relevant consideration in this study. However, it is essential to emphasise that the argument suggesting that children may lose interest after prolonged exposure might not apply in this study's context. Students might not lose interest because children often sustain their enthusiasm for cartoons, even when the content remains consistent, as long as there is diversity and variation within that content. For instance, a case in point is the enduring popularity of SpongeBob among children, where their continued interest is maintained through the introduction of new series and diverse content variations.

I had initially aimed to include more than two government schools utilising the English medium of instruction and an equal number employing the mother tongue medium of instruction in the sample. This approach was partly intended to facilitate a comprehensive investigation into the potential impact of language on Grade 4 science learning when using comics as a pedagogical tool. However, a limitation arose from the scarcity of government schools in the complete towns of the Omusati region, where only three such schools are present. Furthermore, within these towns, only one school in the Junior Primary phase offered instruction in English. It is essential to clarify that

"complete town" means a town equipped with municipal services and amenities that can attract residents from diverse backgrounds.

4.14 Conclusions

This chapter has provided a comprehensive overview of the research methodology, encompassing various facets of the study's design and execution. It outlined the utilization of a true experimental design, involving purposive sampling methods to select critical cases, as well as delineating the research instruments that comprised pre- and post-tests and interviews. The analytical techniques employed encompassed ANOVA for quantitative data analysis and content analysis for qualitative data evaluation. Furthermore, this chapter addressed the paramount aspects of reliability and validity concerning quantitative data while also considering the trustworthiness and credibility of the qualitative data. Ethical considerations were thoughtfully deliberated upon, and the validation process of the comics was explained. The study's limitations were forthrightly presented, and a detailed exposition of the comic preparation process was provided.

CHAPTER 5

The effects of video-mode and book-mode comics on learning attainments in the Grade 4 Science classroom

5.1 Introduction

Chapter four described the detailed research methods employed to gather data concerning the effectiveness of video-mode and book-mode comics, along with the subsequent data analysis procedures. In this chapter, the spotlight is directed towards the outcomes stemming from the quantitative statistical data analysis. The research results presented here offer resolutions to various limitations identified within the extant literature. These limitations encompassed the geographical representation within prior research, the lack of a clear differentiation between video- and book-mode learning outcomes, the scarcity of data pertaining to the efficacy of comics in enhancing learning outcomes during the transition from a mother tongue (Grade 1-3) to English (Grade 4), and the absence of literature concerning the potential of comics to substitute for the teacher in the classroom during lesson presentations. Data were methodically collected from four schools within the Omusati region, all offering Science subjects, to address these limitations. The research design featured a pre-test and post-test framework (Refer to Addendum I and J), enabling the exploration of research questions centred on the impact of comics in video and book modes on learning achievement across three distinct groups (A, B, and C) in each of the four schools. Group A received instruction via book-mode comics, Group B through video-mode comics, while Group C served as the control group, being instructed using traditional teaching methods.

This chapter also delves into the findings, seeking to ascertain whether a statistically significant disparity exists between the two modes of comics when applied in two urban-based schools with differing mediums of instruction. Furthermore, it endeavours to reveal the effect sizes associated with these disparities. The Social Learning Theory underpinned the comic materials employed in this study, and the inquiry aimed to assess the viability of comics as a replacement for a teacher within the classroom context, particularly concerning lesson delivery.

5.2 Comparison of the effects of video- and book-mode instruction versus traditional methods on learning attainment

Finding 1: This study has found a statistically significant disparity in Grade 4 Science learning outcomes among students who were exposed to video-mode and book-mode comic instruction in comparison to their counterparts who received instruction through traditional teaching methods (please refer to Addendum C and D).

Table 5.1: *ANOVA results*

	Sum Sq	Mean Sq	Num DF	Den DF	F value	p-value
School	3170.85	1056.95	3	166	17.90	<0.01
Group	146.64	73.32	2	166	1.24	0.29
Time	9775.40	9775.40	1	166	165.57	<0.01
School*Group	151.75	25.29	6	166	0.43	0.86
School*time	443.16	147.72	3	166	2.50	0.06
Group*time	1494.41	747.20	2	166	12.66	<0.01
School*group*time	346.85	57.81	6	166	0.98	0.44

The data presented in Table 5.1 reveals a significant interaction between the group-by-time effect, indicating that the change from pre-test to post-test results was not uniform across all groups. It becomes evident that this change was more pronounced in the two experimental groups in comparison to the control group, as further illustrated in Figure 5.1. In Table 5.2, it shows the observed distinctions among the groups, specifically between the control group and the two experimental groups. Upon examination, it is apparent that comparisons of the post-test scores of Group C with those of Groups A and B yielded statistically significant differences, with significance levels denoted as $p=0.03$ and $p<0.01$, respectively. These findings are consistent with the data illustrated in Figure 5.2 (Section 5.3)., reinforcing the significant impact of both video-mode and book-mode comics on the enhancement of learning outcomes in the context of a Science subject.

The findings indicating the positive impact of comic materials on learning outcomes in a Grade 4 Science classroom align with the research of Al-Rabaani and Al-Aamri (2017). Their study similarly identified statistically significant differences in learning achievement related to cartoons, favouring the experimental group among Omani Grade 4 students regarding their awareness of water issues. While the focus of their research pertained to a different subject, precisely water awareness, their findings align with those of numerous authors (Marianthi et al., 2008; Hosler & Boomer, 2011; Trnova et al., 2013). These authors similarly observed the positive impact of comic instruction, citing its effectiveness in rectifying misconceptions and enhancing academic performance across diverse subjects. For instance, Koutnikova (2017), Panjaitan et al. (2019), Soewardini et al. (2020), and Harahap and Bukit (2020) reported favourable outcomes associated with comics in the fields of ecology, mathematics, and English. Consequently, the present study's findings align with the existing literature, suggesting that comics could potentially address the underperformance of ESL students in Grade 4 Science classrooms.

The comics were crafted to serve as an interpretive intervention aligned with the specific objectives outlined in the syllabus (see Section 4.10). These comics commendably conveyed the subject matter, comprehensively addressing the intended learning objectives, all without direct teacher involvement. In this regard, Group A engaged with the book-mode comics, while Group B interacted with the video-mode version. The instructional approach was thoughtfully crafted to empower students to replicate the modelled behaviours depicted in the comics through conceptual change. For instance, they conducted an experiment where they attempted to demonstrate that air is indeed matter by swinging a piece of paper in the air, allowing the air particles to make contact with others' faces. This experiment effectively conveyed to the students that although air is invisible, it surrounds us, and one can physically perceive its presence (refer to the similar example given in Section 2.5). Conceptual change takes place as students come to realise that everyday objects such as books, tables, and chairs are considered matter, and this understanding extends to the concept that air is also matter, even though it is invisible (refer to Section 1.2).

The comics also effectively conveyed abstract concepts related to the fundamental particles of matter, as well as the arrangements of these particles in solids, liquids, and gases. Clarifying the structural differences between solid water (ice), liquid water, and steam, which is a gaseous form of water, necessitated a symbolic representation that facilitated comprehension for Grade 4 students. The comics efficiently addressed this subject matter, enabling students to grasp these concepts without needing physical ice blocks or boiling water experiments in the classroom. This improvising allowed students ample opportunity to replicate the content, fostering greater engagement and reinforcing a student-centred pedagogical approach within the classroom. Subsequently, the post-test was administered to evaluate the extent to which the curriculum objectives were achieved. The post-test results revealed the positive effect of comics in enhancing science comprehension.

The positive impact of comics on learning attainment in the absence of a teacher in the classroom underlines the alignment of comic instruction with critical principles of Social Learning Theory, as posited by Bandura (1971). This theory highlights the significance of symbolic representation in situations where the teacher is not physically present. Within this framework, comic materials, whether in book-mode or video-mode, serve as practical tools for fully modelling learning objectives and conveying abstract science concepts within the classroom.

The notion of learning through comics in a teacher's absence finds further support in Syslak's work (2020), which emphasises that comics possess a self-explanatory quality, allowing students to comprehend the lesson's objectives independently. These findings, however, deviate from Sari's perspective (2018), which acknowledges the potential of comics to capture students' attention and enhance their understanding but maintains that comics can only partially replace the teacher's role in the classroom.

In support of Sari (2018), it is essential to note that while this study affirms the insights drawn from Social Learning Theory, it does not advocate for the complete exclusion of teachers from traditional classrooms. Teachers play multifaceted roles that extend beyond the scope of comics, encompassing responsibilities such as creating a conducive classroom environment, serving as role

models, and identifying signs of potential issues or challenges among students. Comics, as an instructional medium, primarily serve an educational purpose and cannot assume the broader social and welfare responsibilities that teachers bear. Teachers function as mentors who inspire students to pursue better futures, and they are also responsible for detecting and reporting any indications of child abuse to the relevant authorities (Vanbaren, 2018).

Comics can substitute for a teacher's role in the classroom when conveying subject knowledge and interpreting the curriculum to students. In this context, both video-mode and book-mode comics serve as autonomous tools for presenting and explaining the subject matter, reducing the necessity for direct teacher involvement in content delivery. This opportunity allows teachers to allocate their attention to other classroom management aspects, such as maintaining student discipline. Consequently, comics emerge as a valuable resource, particularly in scenarios like online learning during pandemics or when schools face unexpected teacher shortages in specific subjects like Science.

Moreover, comics align with the objectives of education reforms in Namibia that advocate for student-centred learning (Awe, 2007; Amakali, 2017; Haimbangu, 2018). Comics have demonstrated their capacity to shift the focus of instructional methods from the teacher to the student, as evident in this study, where students interacted with the comics independently, resulting in significant improvements in learning outcomes compared to traditional teaching methods. Research by Nashir et al. (2021) and Lin et al. (2015) supports the notion that comics can enhance student performance without direct teacher intervention by fostering student engagement and nurturing their interest in the subject matter.

In conclusion, the effectiveness of comics in motivating and engaging students, even in the absence of direct teacher involvement, positions comics as a viable solution to address specific challenges teachers encounter in the transitional Grade 4 Science classroom.

5.3 Comparison of the effects of video-mode and book-mode instruction on learning attainment

Finding 2: This study has revealed that there are no statistically significant disparities in Grade 4 Science learning outcomes between students exposed exclusively to video-mode comic instruction and those solely exposed to book-mode comics.

Despite the absence of statistical significance, it is noteworthy that students exposed to video-mode comics demonstrated higher learning outcomes compared to their counterparts exposed solely to book-mode comics. One of the primary objectives of this study was to ascertain whether a statistically significant difference existed between video-mode and book-mode comics in terms of their impact on learning outcomes.

As depicted in Table 5.2, statistically significant levels were observed for both book-mode comics ($p=0.03$) and video-mode comics ($p<0.01$), and both exhibited a substantial difference in comparison to the control group's post-test results. It is worth highlighting that while video-mode comics yielded a more considerable increase in learning outcomes than book-mode comics, the differences in post-test means between the two were not statistically significant ($p=0.17$). Interestingly, the video-mode, despite not being animated but rather featuring live-action content, exhibited a more substantial improvement. Smith et al. (2012) suggested that computer animation technology may offer more significant advantages to students compared to live-action videos employing human actors. However, our results suggest that while animation may hold certain advantages, live-action videos can also yield significant benefits for student learning.

Table 5.2: *Group*Time - Least Significant Difference (LSD)*

Cell No.	Group	Time	{1}	{2}	{3}	{4}	{5}	{6}
			43.857	48.885	42.451	53.975	42.283	57.183
1	Control	Pre		<0.01	0.55	<0.01	0.51	<0.01
2	Control	Post	<0.01		<0.01	0.03	<0.01	<0.01
3	Book-mode	Pre	0.55	<0.01		<0.01	0.94	<0.01
4	Book-mode	Post	<0.01	0.03	<0.01		<0.01	0.17
5	Video-mode	Pre	0.51	<0.01	0.94	<0.01		<0.01
6	Video-mode	post	<0.01	<0.01	<0.01	0.17	<0.01	

The existing literature scarcely delves into the distinctions between the effects of video-mode and book-mode comics, as evidenced by the limited research on this subject (Jang & Park, 2014; Rokhayani & Utari, 2014; Panjaitan et al., 2019; Soewardini et al., 2019). This gap prompted me to ponder which intervention, whether video comics or book comics, proves more effective in the context of teaching and learning Science subjects at the primary level.

Video comics and book comic interventions, while equally significant, may yield different outcomes due to their unique approaches—one emphasises visual and auditory elements. At the same time, the other combines visual and written components. Although both modes involve visual and textual elements, they represent distinct modes of communication. Unlike listening, reading necessitates a specific skill set for comprehending written content. This distinction may account for the greater significance observed in video-mode comics compared to book-mode comics.

The significance of the video-mode as opposed to the book mode in this study can be likened to IvyPanda's (2020) explanation of the distinctions between books and movies. IvyPanda elucidates that both books and moving images serve as mediums for storytelling, engaging readers and viewers through the use of characters (2020). However, the primary disparity lies in the level of effort required in their production. The author's painstaking efforts to craft a fully detailed book surpass the relative ease with which an actor conveys the message in a movie. Consequently, this

study's findings emphasise a modest yet noticeable disparity between video-mode and book-mode comics. This distinction may be attributed to the disparate levels of effort invested in creating the two forms of media.

Book-mode comics require explicit detailing to enable readers to comprehensively engage with the narrative, akin to the approach taken in a traditional textbook. According to Zhao and Mahrt (2018) noted that book-mode comics require a certain level of reader experience to interpret their intended message, and this demand for interpretive skills might impact book-mode comics more significantly than it would affect video-mode comics. In this study, deliberate attention was given to crafting the cartoons in book-mode, facilitating readers in envisioning the characters Muna and Mega's movements, expressions, and emotions. The students' efforts to decipher the characters' meanings and messages could arguably surpass those required to glean insights from video-mode comics. In the latter, characters in the comics exhibit actions, speech, and emotions overtly, potentially reducing the necessity for advanced interpretation skills. Consequently, the statistical analysis reveals a pronounced significance, with $p < 0.01$ for video-mode comics and $p = 0.03$ for book-mode comics.

While video-mode comics exhibit more significance than book-mode comics, an examination of the results presented in Table 5.2 and Figure 5.1 reveals that the distinction between these two comic formats is not statistically significant ($p = 0.17$). Given that the p-value exceeds the threshold of 0.05, it suggests that the observed difference between the two comic modes could occur purely by chance. Consequently, it is imperative to conduct further research explicitly dedicated to elucidating the disparity between video-mode and book-mode comics. Such additional research, featuring a sample of different sizes, can help confirm or refute the current findings. This idea is particularly pertinent because minor differences between variables drawn from limited samples may yield insignificant results. Therefore, a larger sample size, even if yielding a slight difference in the average mean, can definitively ascertain whether this disparity holds statistical significance.

As it stands, the study's outcomes do not indicate a statistically significant divergence in learning attainment between video-mode and book-mode comics interventions.

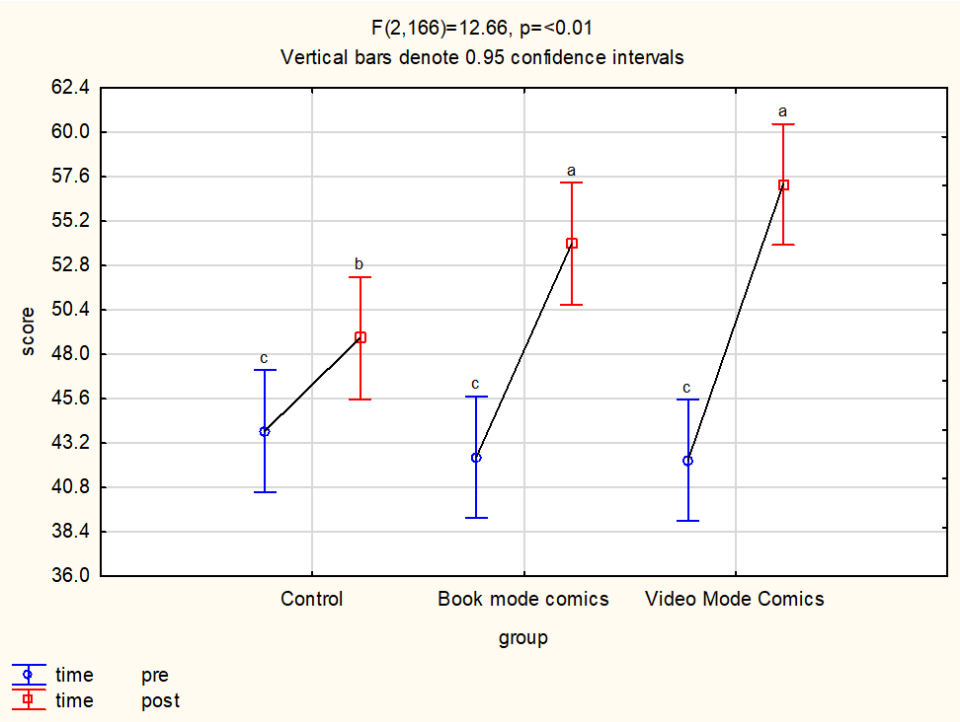


Figure 5.1: *Group*Time Least Square (LS) means graph.*

5.4 The differences in learning attainments between town schools (Schools S1 and S4) in both video- and book-mode

Finding 3: This study found a significant disparity in Grade 4 Science learning achievements between students from School S1 (where English is the medium of instruction in Grades 1 through 3) and School S4 (where Oshindonga is the medium of instruction in Grades 1 through 3), despite their shared educational environment.

The study aimed to investigate potential significant differences between two urban primary schools, School S1 and School S4, located in a similar environment but employing different mediums of instruction. School S1 utilises English as its medium of instruction, whereas School S4 employs Oshindonga, a local language. Figures 5.2 and 5.3 depict that School S1 outperformed the other three schools, while School S4 exhibited similar performance levels as School S2 and School

S3. The statistical disparities between these schools are presented in Table 5.3, indicating that S4 significantly differed from S1 ($p < 0.01$) and did not exhibit significant differences from S2 ($p=0.54$) and S3 ($p=0.15$).

Table 5.3: *School least significant difference*

	School	{1}	{2}	{3}	{4}
		58.911	44.322	46.379	42.811
Cell No.					
1	S1		<0.01	<0.01	<0.01
2	S2	<0.01		0.41	0.54
3	S3	<0.01	0.41		0.15
4	S4	<0.01	0.54	0.15	

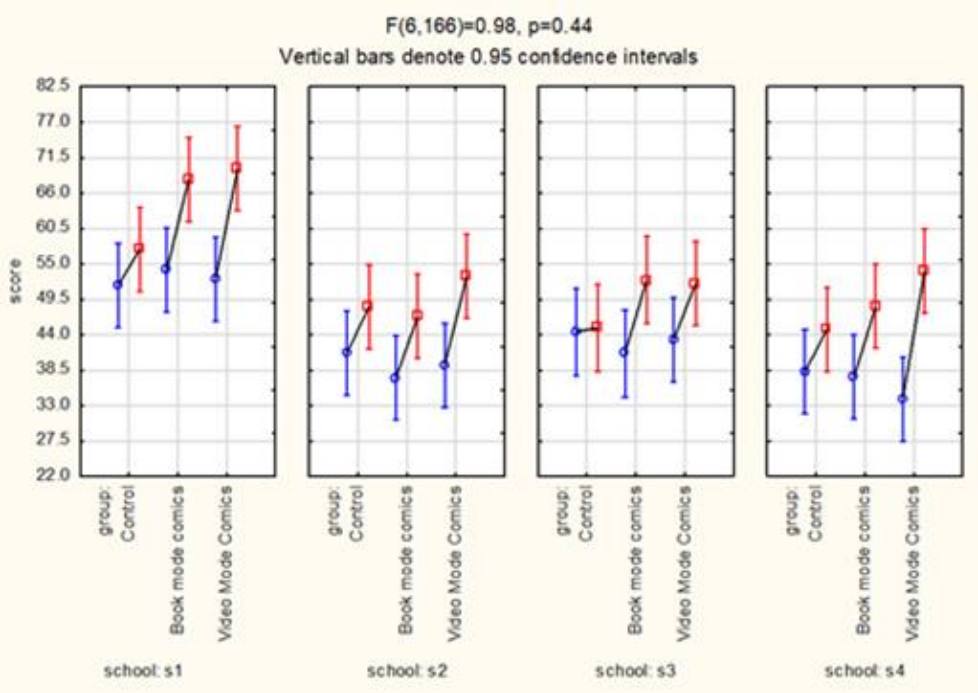


Figure 5.2: *School*Group*Time LS means graph.*

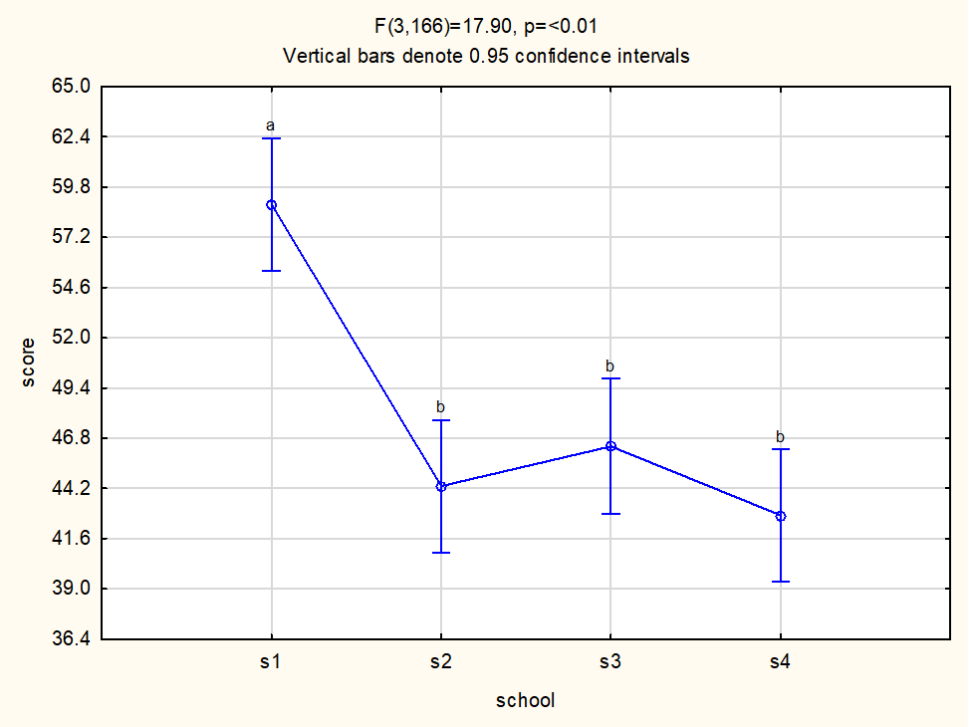


***Figure 5.3**: School LS means graph*

The results revealed that the school in the town outperformed all other schools in the tests. This finding aligns with the arguments presented by Ghazi and Ullah (2015), asserting that schools in urban and rural areas exhibit distinct sociocultural environments. These disparities, including varying exposure to television, top-rated cartoon programs like Spongebob Squarepants, Amazing World of Gumball, Summer Camp Island, and others, can significantly influence the learning experiences of Piaget's concrete operational stage students and Vygotsky's ZPD in the realm of science education. The anticipation was that learning achievements in comic instruction would be comparable between Schools S1 and S4, as they shared a similar level of comic literacy exposure. However, School S1, despite its shared urban location with School S4, demonstrated a higher mean score, while School S4's performance resembled that of schools situated in rural areas.

Schools S1 and S4 share familiar sociocultural environments, which might have been expected to exert a similar influence on the concrete operational stage of Piaget or ZPD aspects of Vygotsky. However, despite this commonality, School S4 exhibited a significant difference in performance compared to School S1 but showed similarities with schools situated in rural areas. This divergence

raises questions about the distinct school and classroom procedures implemented in these two schools. As emphasised by Haimbangu (2018), school and classroom procedures represent crucial factors that can significantly impact student performance in a Science classroom. Haimbangu emphasises that even if schools implement the curriculum with equivalent efforts, differences in school and classroom procedures can lead to variations in academic performance (2018).

One significant divergence in school and classroom procedures between Schools S1 and S4 pertains to the medium of instruction. Henderson and Wellington (1998) contend that one of the most prominent barriers impeding effective science learning for many students is the language barrier. For instance, a school employing a language of instruction in which students are not proficient can have detrimental effects on their learning achievements. In the case of these two schools, School S4, similar to village schools, employs a local language as the medium of instruction from pre-primary to Grade 3. In contrast, School S1 consistently uses English as the medium of instruction. Consequently, students at the same cognitive developmental stage may have different experiences in acquiring science concepts due to external factors such as the sociocultural environment and the medium of instruction they were exposed to prior to their promotion to Grade 4.

Language proficiency and comic literacy are among the factors that can potentially impact the learning of science concepts when employing comic instruction. Probyn (2006) has underscored the significance of language proficiency in enhancing students' comprehension of scientific concepts. Cultivating language proficiency, whether in English or another language, from an early age is a factor that may contribute to enhanced proficiency and positive learning outcomes, as emphasised in Probyn's research from 2006.

Consistency in the medium of instruction throughout a student's schooling without language transitions may also play a role in academic performance. For example, students at School S1, who received instruction in English from pre-primary to Grade 4, demonstrated statistically significant performance differences compared to other schools that used Oshindonga as the medium of instruction up to Grade 3 and then transitioned to English starting in Grade 4 (Figure 5.3).

Proficiency in the language used in the classroom is essential for unpacking the message conveyed by any teaching intervention, as emphasised by Rollnick (2000), Mammino (2010), and Nishanthi (2020).

Similarly to language proficiency, the concept of comic literacy is noteworthy. Exposure to cartoon films through various technological devices may contribute to comic literacy, potentially enhancing learning outcomes during comic instruction. This perspective aligns with McVicker's (2018) discussion of comics possessing visual learning characteristics, mainly when students are visually literate.

The results of this study indicate that the benefits of learning attainment through comic instruction are not exclusive to schools with English as the medium of instruction but extend to all schools that participated in the study. These expected benefits suggest that comic instruction can potentially enhance learning outcomes for all students, regardless of their language proficiency. However, the impact may be more significant when students are proficient in the language of instruction. This interpretation is evident from the results presented in Figure 5.1 in Section 5.3 and Figure 5.2 above. Both modes of comic instruction exhibit a statistically significant difference compared to traditional methods, with School S1 demonstrating a more pronounced statistically significant difference than School S4 and the other schools.

However, it is essential to note that while this study identified differences in learning gains between two schools in the same environment with different language policies, it cannot conclusively attribute these differences solely to the language policy. Other underlying factors may also be at play. This limitation arises from the relatively small number of urban schools with varying mediums of instruction included in the study sample. Further research involving a more extensive and diverse sample, including schools with English and local languages as mediums of instruction, is needed to comprehensively investigate the impact of language on learning science concepts in Grade 4 classrooms.

5.5 Measuring the effect size on learning attainments in video-mode and book-mode comics

Finding 4: This study found that there is a large practical important difference between the pre-test and post-test of the video-mode and book-mode. At the same time, there is a medium practical important difference between the pre-test and post-test of the control group.

Therefore, although the p-values associated with learning attainment in video-mode and book-mode indicate the presence of effects, they fail to quantify the magnitude or practical importance of these effects. In order to gauge the practical importance of the performance variation between the pre-test and post-test, Cohen's d was employed to measure the effects on learning attainment (Diener, 2010). Specifically, the differences in learning gains between the pre-test and post-test for comics in book-mode were recorded at 0.76, for video-mode at 1.01, and for the control group at 0.4. Cohen's d results for book-mode and video-mode comics exhibit a more substantial effect in comparison to the control group (as presented in Table 5.4) despite the negligible disparities detected among the three pre-tests prior to the intervention.

An intriguing observation from Table 5.4 is the effect size discrepancy between video-mode and book-mode comics, which stands at 0.20, indicative of a small practical importance. Consequently, while the statistical difference between video-mode and book-mode surpasses the significance threshold of 0.05, suggesting no statistical significance, the practical importance of this discrepancy is small. In light of this, it is reasonable to conclude that, even though the statistical difference between video-mode and book-mode may not be deemed statistically significant, the observed difference does possess small practical importance and should not be disregarded (for additional details, refer to Addendum C for insights from Hedge's G). Hence, it is crucial to acknowledge the complexity of drawing conclusions about statistical significance when the p-value approaches the significance threshold. This cautionary stance finds support in the work of Amrhein et al. (2019), who advocated for vigilance among researchers when interpreting p-values and considering significance thresholds. It is essential to clarify that their perspective did not advocate for an outright ban on using p-values, nor did they assert that p-values are unfit for use as decision

criteria in specific specialised applications; instead, they emphasised exercising prudence in their interpretation and application.

Table 5.4: *Cohen's d results*

	Group	Time	{1}	{2}	{3}	{4}	{5}	{6}
1	Book	Post		0.76(larg)	0.34(smal)	0.74(med)	0.20(smal)	0,8(larg)
2	Book	Pre	0.76(larg)		0.46(med)	0.11(negli)	0.97(larg)	0.01(negli)
3	Contr	Post	0.34(smal)	0.46(med)		0.40(med)	0.55(med)	0.48(med)
4	Contr	Pre	0,74(med)	0.11(negli)	0.40(med)		0.97(larg)	0.12(negli)
5	Video	Post	0.20(smal)	0.97(larg)	0.55(med)	0.97(larg)		1.01(larg)
6	Video	Pre	0.80(larg)	0.01(negli)	0.48(med)	0.12(negli)	1.01(larg)	

Cohen's d results pertaining to the practical importance of the disparity between the pre-test and post-test outcomes for comics and traditional instructional methods imply that comics align with the conclusions drawn by Hosler and Boomer (2011). In their study, Hosler and Boomer (2011) similarly reported a substantial and practically important enhancement in the performance of biology students following their utilization of comic books. The findings of Hosler and Boomer (2011) stress the intricate synergy of text and visual elements within comic books, which enhances the likelihood of students comprehending scientific concepts and, concurrently, experiencing heightened motivation.

The images featured in the book-mode comics used in this study were crafted to seamlessly integrate movement, the expression of emotions, and the communication of intentions with the accompanying text. This intricate fusion of visuals and text within speech bubbles creates a dynamic interplay, enabling the comics to effectively elucidate, illustrate, and elucidate subject matter even in the absence of a teacher in the classroom. The inherently self-explanatory nature

of comics renders them more potent in symbolically modelling instructional content than traditional textbook images.

Consequently, the symbolic modelling facilitated by comics, coupled with their capacity for entertainment and humour, can foster a more conducive environment for student engagement and motivation than conventional teaching methods. Characters featured in both video-mode and book-mode comics possess the capacity to captivate and amuse students in ways that an ordinary teacher may not, as they can engage in unconventional and out-of-the-ordinary actions. This captivation and amusement, in turn, creates a classroom environment conducive to motivation and a genuine interest in the subject matter, particularly in the realm of Science. Motivated students tend to hold a positive perception of comics, reinforcing their engagement and ultimately resulting in enhanced learning outcomes (Hosler & Boomer, 2011).

These findings align with the conclusions drawn by other researchers in the field of comics, including Marianthi, Boloudakis, and Retalis (2008) and Trnova, Trna, Vacek, Costa, Dorio, and Kires (2013). Their studies also highlight the positive views held by students regarding the effectiveness of comics as an instructional approach, primarily due to comics' ability to address misconceptions and enhance academic achievement. Given the abstract nature of Science, the subject is particularly susceptible to misconceptions that can impede student learning. Consequently, comic instruction has demonstrated its effectiveness in the Science classroom, particularly for English as a Second Language (ESL) students who may need to improve in the language. Furthermore, it has the potential to contribute significantly to learning attainment even in the absence of a teacher as the primary lesson presenter.

5.6 Testing hypotheses

The hypotheses initially outlined in Chapter 1 have been subjected to testing through LSD post hoc tests conducted across the various groups, and the outcomes are detailed in Table 5.5. This comprehensive table communicates the outcomes of these hypotheses, revealing a noteworthy pattern. Expressly, three of the null hypotheses have been unequivocally rejected, as they fail to

align with the empirical results generated by the study. Conversely, one null hypothesis has emerged as congruent with the observed data. Specifically, this null hypothesis asserts that teaching instruction employing video comics does not yield significantly greater impacts on student academic performance in primary science when compared to teaching utilising book comics.

Table 5.5: *Results of tested hypotheses using t-tests across the group.*

Alternate Hypotheses	Null Hypotheses	Results
Teaching that uses video-mode comics has a greater effect on student learning attainments in primary science than traditional science teaching.	Teaching that uses video-mode comics has no greater effect on student learning attainments in primary science than traditional science teaching.	I found a difference in average achievement between video-mode comics and traditional science teaching to be 8.50, with a p-value of <0.01, consistent with my alternate hypothesis
Teaching that uses book-mode comics has a greater effect on student academic performance in primary science than traditional science teaching.	Teaching that uses book-mode comics has no greater effect on student academic performance in primary science than traditional science teaching.	I found a difference in average achievement between book-mode comics and traditional science teaching to be 5.25, with a p-value of 0.03, consistent with my alternate hypothesis
Teaching that uses video comics has a greater effect on student academic performance in primary science than teaching using book comics.	Teaching that uses video comics has no greater effect on student academic performance in primary science than teaching using book comics.	I found a difference in average achievement between video-mode comics and traditional science teaching to be 3.25, with a p-value of 0.17, which is consistent with my null hypothesis
Teaching that uses video- and book-mode comics has a greater effect in an urban primary school with an English medium of instruction than in an urban primary school with a mother tongue medium of instruction.	Teaching that uses video- and book-mode comics has no greater effect in an urban primary school with an English medium of instruction than in an urban primary school with a mother tongue medium of instruction.	I found a difference in average achievement between video-mode comics and traditional science teaching to be 18.00, with a p-value of <0.01, consistent with my alternate hypothesis

5.7 Conclusions

This chapter delves into the comprehensive analysis of the study's quantitative data, specifically exploring the impact of video-mode and book-mode comics on learning attainment. The findings illuminate the positive effects of both comic modes, whether in book-mode or video-mode. Moreover, the chapter underscores the notable disparities observed between the two comic modes and between the two urban schools, which are further explained in the ensuing discussion. Notably, the statistical analysis reveals a p-value discrepancy between video-mode and book-mode comics, although this disparity ultimately lacks statistical significance.

The urban primary school utilising English as the medium of instruction exhibited a stronger p-value compared to the urban primary school employing a local language as the medium of instruction. However, it is imperative to emphasise that further research is required to establish this conclusion firmly. Additional variables that could potentially influence the outcomes must be carefully assessed and controlled for in subsequent investigations. Additionally, the sample size employed in this study may not be sufficient to lend statistical significance to the particular finding on the difference between video- and book-mode comics.

Furthermore, the findings provide support for Bandura's Social Learning Theory (1971), suggesting that symbolic representation can enhance learning even in the absence of a teacher within the classroom. To quantify the magnitude of learning gains attributed to the two interventions, Cohen's d was computed, indicating that both video-mode and book-mode comic instructions have a significant impact on the learning attainments of Grade 4 Science students, with a small practical difference observed between the two comic modes.

CHAPTER 6

Teachers' experiences using video-mode and book-mode instruction in primary Science classrooms

6.1 Introduction

The literature review revealed the effectiveness of comics in various classroom subjects, including languages, Ecology, Mathematics, and Science. It also underscored the challenges impeding the implementation of comic instruction in educational settings, such as a lack of drawing skills, issues related to time management, misconceptions associating comics with entertainment, and the stance of government education ministries towards comics. Despite this insightful literature review, a notable gap exists in comprehensive data addressing the precise factors constraining the utilisation of comics as primary educational tools. The literature falls short of fully identifying or addressing the underlying reasons behind the limited integration of comics in classrooms, potentially hindering their broader application in educational settings.

Chapter 5 delved into investigating the effectiveness of video- and book-mode comics on learning outcomes in Grade 4 Science classrooms with ESL students from various Medium of Instruction (MOI) contexts. In Chapter 6, the focus shifts to exploring teachers' experiences when employing comic instructional methods, along with the challenges students encounter in this context. The chapter also outlines strategies to enhance the utilisation of comics in educational settings. The chapter begins with biographical descriptions of the four participating schools and their respective Science teachers, followed by presenting findings from teacher interviews. The qualitative data findings are structured thematically, with connections drawn between these findings and the existing literature to highlight the linkages between teacher experiences and the broader educational landscape. These findings are subsequently discussed as part of the concluding remarks.

6.2 Background information

Collecting background information from schools and participants was essential to provide context for the study's results and to establish the connection between schools and individuals and the status of comic instruction in the Omusati region. Biographical data served to differentiate schools and participants from one another and to offer insights into the influence of individuals on the state of comic instruction in classrooms. During the interview sessions, teachers were asked to provide information about themselves and the biographical characteristics of their schools. This information is presented to provide readers with a comprehensive understanding of the schools and individuals whose insights are discussed in this chapter.

The study revealed that School S1 lacked computers or other technological devices that teachers could use for planning and preparing comic-based lessons in the Science classroom. Schools S2 and S4 had some computers and laptops available for teacher use during lesson planning and preparation. School S3, on the other hand, had a limited variety of technological devices such as computers, laptops, televisions, and tablets, but more than any other school. In summary, most schools needed more technological resources for planning and creating comics in the Science classroom, including modern computers with the necessary software and the requisite skills to generate comic books.

Additionally, the study found that most primary schools had internet access ranging from 'good' to 'excellent', with only School S1 lacking internet connectivity. The state of internet access in primary schools indicated that Science teachers with the requisite skills for comic production could utilise the internet to download software for creating comics, offering a more streamlined alternative to traditional hand-drawn methods.

The interviews included nine Grade 4 Science teachers from four schools, revealing that most had less than two years of experience teaching the Grade 4 Science subject. Two teachers had taught Science in Grade 4 for a period ranging from three to ten years, while one teacher possessed over a decade of experience in this capacity. These participants had undergone teacher training at

different times and accrued varying years of teaching experience. This diversity in training and experience informed the study's insights into the status of comic instruction at the university level, where these teachers received their training and at the school level where they currently teach.

6.3 Research findings

This section presents the findings of various themes identified through a deductive approach. The deductive nature of the themes was grounded in a predetermined understanding of the likely themes within the dataset (Bingham & Witkowsky, 2022). This deductive thematic analysis served as an organisational tool to ensure that the collected data aligned with the research questions. It facilitated a focused exploration guided by the research's primary purpose: investigating teachers' experiences with comic instruction, the challenges encountered during its implementation, and the strategies required to address these challenges.

To begin the qualitative data analysis in this study, I initially established categories of interest based on the research questions and categorised the data accordingly. The presentation of findings then proceeded in the form of themes and sub-themes, with transcribed quotations from the respondents included to substantiate the results. These themes and associated findings were developed deductively to accommodate the analysed and transcribed dataset. Table 6.1 below provides an overview of the themes and their respective findings.

Table 6.1*: Themes that were developed from the collected data*

Themes	Findings
Theme 1: Teachers perceive comics as effective tools in the classroom, particularly in fostering learning engagement, facilitating assessments, and enhancing practical activities. However, it is noteworthy that the majority of classrooms appear to underutilise comics, with minimal to no incorporation into their teaching practices.	Finding 1: There is little to no comic instruction in the teaching of primary science. Finding 2: Teachers experience comic instruction as more effective in the teaching of primary science than traditional methods of instruction. Finding 3: Students pay more attention to comics than to traditional methods of instruction. Finding 4: Comic-based assessment activities are more effective compared to traditional methods of instruction.

	Finding 5: Practical activities with comics are more effective compared to traditional methods of instruction.
Theme 2: Both teachers and students encounter challenges when implementing comic-based instruction in the science classroom.	Finding 6: Teachers face challenges during the preparation of comics. Finding 7: Teachers face challenges during teaching presentations with comic instruction. Finding 8: Students face challenges when they are learning with comics. Finding 9: Experts in educational comic production are not available in the communities concerned.
Theme 3: The challenges facing teachers and students could be addressed after employing some mitigation strategies on the employment of comics.	Finding 10: Challenges associated with the preparation of comics could be addressed by the training from the local institutions of higher learning; provision of finances and comic books from the ministry of education; and comic workshops and seminars from regional directorates of education. Finding 11: Teaching and learning challenges with comics can be addressed when every student has an opportunity to watch cartoon programmes on television at school; remedial teaching in reading is employed; different reading programmes are in place at school; and the language policy is revisited so that there is no transition in the language of instruction between phases. Finding 12: Minimal use of comic instruction in Namibian classrooms should be addressed by increased internet coverage, provision of physical resources like printers and computers, and motivating teachers to go the extra mile during teaching and learning.

6.4 Theme 1: Teachers perceive comics as effective tools in the classroom, particularly in fostering learning engagement, facilitating assessments, and enhancing practical activities. However, it is noteworthy that the majority of classrooms appear to underutilise comics, with minimal to no incorporation into their teaching practices.

This study aimed to uncover the experiences of Grade 4 Science teachers with comic instruction in their classrooms. The research involved nine Grade 4 Science teachers from the four selected schools, who gained new insights and experiences through the processes of preparing comics, delivering lessons with comics, and observing students as they learned through comics. Notably, the students engaged with comic materials that partly replaced the traditional teacher-led instruction within the classroom. While the teachers did not assume their usual teaching roles during this period, they were permitted to sit at the back of the classroom and witness the entire instructional process. Remarkably, all teachers expressed a strong interest and willingness to incorporate comics into their future classroom activities. This sentiment was echoed by Teacher S2T2 whose feedback aligns with the overall cheerful disposition of the participating teachers towards integrating comics into their teaching practices.

> *I have been using several teaching methods during my teaching career, but I never used comic instruction. I had no idea what comic instruction was all about. But my eyes are now open, and I will try my best to use comic instruction in the future. I think it will make my teaching presentations easier and more succinct. This is a great opportunity for me, my students, and the whole community at large.*

These words may initially imply that teachers lacked familiarity with comic instruction; however, they subsequently acknowledged the positive influence of this study on their knowledge and experiences. Furthermore, they expressed a genuine eagerness to incorporate comics into their future classroom practices. Consequently, this study delved into the particular knowledge and experiences that teachers gained during the research, shedding light on why they perceived their perspectives as having evolved and why they were inclined to continue utilising comics beyond

the study's conclusion. The study findings unveiled the teachers' specific experiences with comics, which are outlined as follows:

6.4.1 Finding 1: There is little to no comic instruction in the teaching of primary science.

The existing literature on comics in educational settings primarily originates from specific regions, namely Asia, Europe, and the Americas, which share relatively similar classroom contexts characterised by well-equipped facilities and the availability of educational technology for comic production. However, it is important to note the absence of comparable studies conducted in Africa as a whole and Namibia in particular. In the African context, classrooms often grapple with resource limitations, and some educators may possess only semi-qualifications. This scarcity of comic-related research in Africa raises concerns about the potential underutilisation of comics as a teaching tool. To gauge the accessibility and utilisation of comics among the participating teachers, I inquired about their prior experiences with comics in their teaching careers. The responses uniformly indicated that none of the teachers had previously employed comics in their teaching practice. Furthermore, some teachers disclosed that they had never encountered comic instruction due to their lack of training in comics, limited drawing skills, and insufficient resources for comic creation. The perspective expressed by Teacher S1T1 aligns with these findings.

> *…I never used comics before during my teaching career. I was never taught or get trained on how to make or use comics. Comic instruction was never part of the studying points when I was at the university, and I did not attend any in-service training or workshop on it. I never came across the teaching methods of comics and I'm not good at drawing, so I cannot come up with comics without any assistance. It is hard for me [to produce comics that could be used effectively in the classroom].*

Based on the sentiments expressed above, it is evident that comic instruction is not a frequent occurrence in Namibian schools. Teachers in the study indicated a conspicuous absence of both book- and video-mode comics in their Science classrooms. They conveyed that they had never integrated comics into their teaching practices and had limited exposure to comics in their personal lives. Several factors contributed to this non-usage, with a prominent one being the need for more training and artistic proficiency. The teachers pointed out that their university education

did not encompass training in comic-based instructional methods, leaving them unaware of the potential utility of comics in teaching.

Furthermore, they expressed challenges related to comic production, citing an inability to draw cartoons and a lack of acting skills necessary for video creation to convey syllabus objectives effectively. Additionally, there was scant awareness among teachers about the existence of comic software packages that facilitate comic creation. This limited awareness might stem from the misconception that comic creation necessitates strong drawing abilities. Nevertheless, it is essential to note that producing comics does not inherently require artistic skills, as numerous comic software packages are available, enabling individuals to create comics without advanced drawing capabilities. In response to the absence of comics in the classroom, Teacher S1T3 expressed:

> *No, I never used comic instruction before! Lack of resources like computers, cameras to come up with video comics and colour printers to come up with book comics is one of the factors. Furthermore, we have no access to the internet at our school... Another problem which is likely to negatively impact the employment of comics in the classroom is time. We [teachers] don't have time to come up with comics because our daily schedules are full.*

The sentiment expressed emphasises the financial constraints and resource limitations that hinder teachers from incorporating comics into their teaching practices. Inadequate funding to procure essential materials and equipment for drawing and printing cartoons emerges as a major obstacle. Teachers require various resources, including computers, cameras, internet connectivity, televisions, mascot suits, and other suitable devices for creating both video- and book-mode comics. Notably, internet access plays a pivotal role in facilitating Science teaching, enabling the downloading of comic software packages and ready-made comics. Consequently, the absence of internet connectivity poses a significant barrier to the adoption of comic instruction.

Moreover, the creative production of cartoons for book-mode comics is contingent on the availability of colour printers in schools. Coloured cartoons are more engaging for students compared to black and white ones. Consequently, the absence of necessary equipment and

devices within schools hinders the implementation of comic instruction, rendering it underutilised or non-existent in the classroom.

Time constraints also factor into the limited use of comics. Teachers expressed that they often lacked sufficient preparation time to create comics, potentially due to demanding school schedules and teaching loads. When teachers are overwhelmed with their responsibilities, they may find it challenging to explore new methods, such as incorporating comics into their teaching. One teacher articulated this challenge by stating:

> *No, I never used it in my teachings… the current school funding system is not sufficient to allow schools to use comics. After the government replaced the School Development fund from parents with Universal Primary Grant directly from the Ministry of Education, money is never enough. Universal Primary Grant is not enough and when it is paid, it comes very lat.e. The unavailability of funds negatively affects the procurement of materials needed to produce comics. (Teacher S2T1).*

The narrative provided sheds light on the current funding system in Namibian schools, which poses a significant barrier to the adoption of comics in the classroom. Schools in Namibia receive an annual government grant, which has replaced previous school development funds paid by parents. However, teachers expressed that this grant is insufficient to support the implementation of comic instruction. Inadequate funding limits schools' ability to acquire the necessary devices for comic instruction, pay for internet connectivity, and obtain comic software packages. Adequate financial resources are essential for schools to explore new methods that can benefit students, including the integration of comics into teaching.

It is noteworthy that while all teachers indicated that they had never used comic instruction, one teacher mentioned using comics on a single occasion. Subsequently, the teacher provided evidence in the form of images from a Science textbook. However, upon closer examination, these images did not align with the definition or representation of comic instruction. This finding reinforces the notion that teachers in the Omusati region had limited awareness of comics until their participation in this study, as confirmed by Teacher S1T2, who stated:

> *...this is not the first time I used the comics. It is just that not that most often. I once used comics in one lesson when I was teaching the theme of Water Circle in Grade 5 the other year. I think students liked the lesson because of the comics.*

In summary, teachers have pointed out several challenges that hinder the integration of comics in Namibian classrooms. These obstacles include insufficient training, limitations in artistic skills, time constraints, resource scarcity, and financial constraints. Overcoming these challenges would require collaborative efforts from educational authorities to provide training, resources, and support for innovative teaching approaches like comics.

6.4.2 Finding 2: Teachers experience comic instruction as more effective in the teaching of primary science than traditional methods of instruction.

In Chapter 5, the study demonstrated the effectiveness of both video- and book-mode comics in enhancing learning outcomes in the Science classroom. In this chapter, teachers were invited to share their perspectives on comics after actively participating in the entire production process and implementing comics as a teaching tool in their classrooms. When asked about their views on whether comic instruction could effectively enhance students' understanding of science concepts, their responses reinforced the findings presented in Chapter 5 regarding the positive impact of comics. Teachers expressed agreement with the notion that comics have a beneficial influence on learning attainment in the Science classroom. This sentiment is exemplified by the following response from Teacher S1T1:

> *Yes, comic instruction is very effective, in the sense that it is fun, creative and ... with comics, [learners] can see what they cannot see when I am using ordinary teaching methods. I mean comics could bring the objects into the classroom as if they are concrete materials. Students learning with comics are paying more attention as most of the children love cartoons.*

These expressions highlight the effectiveness of comic instruction in the Science classroom, primarily because it is engaging and imaginative when compared to traditional teaching methods. Teachers attribute the effectiveness of comics to their inherent ability to captivate students, a quality shared with many children's television programs presented in comic or cartoon formats, which are designed to capture children's attention. Consequently, comic instruction is viewed as a valuable tool for rendering science concepts interesting, enjoyable, and comprehensible for

primary school students. Given the typically abstract nature of science concepts and the potential for misconceptions, comics play a vital role in facilitating students' understanding of non-physical concepts. They achieve this by allowing students to experience scenarios that would otherwise remain confined to their imagination.

For instance, when teaching abstract concepts such as the particles of matter in science, which are invisible to the naked eye, comics prove to be a more effective tool than traditional methods. As one teacher noted:

> *Comics are effective when learning Science because it is fun and interesting to the students. It'll make the [learners] remember the presented subject matter effectively because they would keep the images in their minds for a longer time [than learning from texts]. Therefore, with longer retention of learned skills and objectives, students' academic performance at Grade 4 level could be enhanced. (Teacher S1T2).*

Beyond the entertainment value, this narrative emphasises that the effectiveness of comics is also influenced by their content structure. Comics are predominantly image-based, featuring more visuals than text. Research has shown that visuals, whether in video-mode or book-mode, tend to be retained in memory for a longer duration compared to traditional textual content. For example, according to Shabiralyani (2015), a picture is often said to be worth a thousand words, indicating that interpreting the message conveyed by an image may require less time and cognitive effort than reading paragraphs of text to grasp the same information. Moreover, images are more likely to be stored in long-term memory, making them easier to recall than lengthy textual descriptions of the same subject matter. This principle is also evident in advertising, where visual content, composed of images and graphics, is frequently used to convey messages that can be quickly comprehended by consumers and remembered over time.

Furthermore, another teacher, Teacher S1T3, elaborated on the broader effectiveness of comics beyond the classroom.

> *Because it is funny to teach students with comics, it helps students to pay more attention, and remember more easily, and it also catches the interests of students of different abilities. On the other hand, comics can be advantageous when given to parents so that students can learn at home where there is no teacher present [due to unforeseen circumstances]*

The quotation underscores that both video-mode and book-mode comics exhibit greater effectiveness compared to traditional teaching methods because comics can be taken home by students for further reinforcement after the lesson. The self-explanatory nature of comics, enabling them to elucidate and describe various phenomena without the need for a teacher's presence, renders them valuable tools for parents to assist their children in learning science at home. This capability alleviates the burden on parents who may not fully grasp the intricacies of a science subject, enabling them to support their children's learning outside of school hours. The effectiveness of comics in extracurricular settings extends their utility to online learning, a crucial platform during school closures resulting from natural disasters and pandemics such as floods and COVID-19.

6.4.3 Finding 3: Students pay more attention to comics than to traditional methods of instruction.

Improving student engagement with science and fostering the development of essential skills and comprehension of scientific concepts has posed a persistent challenge for Science educators (Hadzigeorgiou & Schulz, 2019). Consequently, comic instruction emerges as an alternative approach to effectively engage and motivate students, positively influence their mood to enhance attentiveness, and facilitate a deeper understanding of science concepts, especially in the context of the demanding transitional Grade 4 curriculum. In this study, teachers perceived that students demonstrated increased attentiveness during lessons involving comic instruction compared to traditional teaching methods. The following statements from teachers corroborate these observations:

> *They were more … [paying attention] than when using the usual teaching methods as many children of today like watching cartoons. More than 80% of students in the classroom were listening attentively as a result of being attentive through observing. This is true even at home … Much of the knowledge and skills acquired by children nowadays have been learned from watching cartoon programmes on TV. Students were even asking if they can watch again (Teacher S1T1).*

> *They are more [sic. engaged] as they pay more attention when learning with comics than other methods. [Children] enjoy watching cartoons. Cartoons [comics in both modes] can*

> *enhance attentiveness in students because they are colourful, funny and act unusually compared to teachers (Teacher S1T3).*

The expressions above highlight the capacity of comics to extend students' attention spans during Science instruction. Young students often watch cartoons on television at home independently and attentively, learning significantly from these experiences. Similarly, within the classroom, they engage with comics with a high level of attentiveness, driven by the inherent enjoyment they derive from comics. This intrinsic motivation leads students to immerse themselves in reading comic books and watching videos without external prompting or coercion. Comics possess a unique quality that captivates students, allowing them to take the lead in their learning process and progress at their own pace, free from disruptions caused by peer interactions. Moreover, the use of teacher-inspired characters in non-face-to-face learning settings has further enhanced students' attention. As evidenced in the narrative below, Teacher S2T1 affirms that students exhibited greater attentiveness while learning Science with comics, even when the teacher was not the primary presenter of the lesson.

> *I did not participate nor contribute to the teaching and learning in class. [Learners] were solely taken through the specific objectives of the lesson by the comics. This was very remarkable because it revealed that [learners] listened attentively when learning with comics with a teacher present or not. In fact, I was just sitting at the back of the class, and they did not know if there was a teacher present. Amazingly, comics managed to present the subject to the [learners] without any effort from my side.*

The extended attention span reported by teachers in association with comics suggests that students were engaged in learning out of excitement rather than feeling obligated, as is often the case with traditional methods. Therefore, the enthusiasm generated by comics contributed to increased student attention. Importantly, it became evident that this attention span was not contingent on the presence of the teacher. Conversely, learning driven solely by obligation, where students are not inherently motivated by excitement, may lead to boredom and a decrease in attention span.

In conclusion, teachers affirmed that comics have the capacity to captivate students' attention, thereby positively impacting their comprehension of science concepts and retention, even when

students may encounter challenges with the language used in the material. This is attributed to the allure of the comics lying not in the language employed but in the characters themselves.

6.4.4 Finding 4: Comic-based assessment activities are more effective compared to the traditional methods of instruction.

Assessment is considered effective when it aligns with its intended purpose and can be easily administered to students. This raises the question of whether the assessment in comic instruction is suitable for its purpose and if it can be seamlessly administered. While the previous chapter of this study showcased the effectiveness of comics in facilitating Science learning for Grade 4 ESL students, it did not explore the feasibility of conducting assessments in this classroom setting without direct teacher involvement.

During the interviews, I inquired with the teachers about the adequacy of assessment within the context of comic instruction. All participants unanimously acknowledged the effectiveness of comic-based assessment, as reflected in the following statements.

> *Comics had time space dedicated to the assessment activities for the [learners] to solve. Especially with the video mode comics, the time duration was standing out while relaxing music was heard in the background. [learners] enjoyed being assessed as they tried to accumulate as many points as possible. I can say, [learners] were effectively assessed. Comic activities were fun but still were set as per the basic competencies, and this was done after every part of the [lesson] presentation (Teacher S1T1).*

This narrative highlights the effectiveness of assessment within the comic instruction framework in the primary Science classroom. Teachers perceived the assessment activities as well-crafted to align with the fundamental competencies of the syllabus, despite the entertaining elements associated with comics. Comics provided ample opportunity and time to assess students effectively across all basic competencies, as outlined in Section 4.10.

The quality of assessment questions also plays a pivotal role in determining the effectiveness of the assessment process. Assessment activities tailored to the curriculum objectives are more likely to meet the appropriate standard and level of difficulty for that grade. Additionally, the reasonable

frequency of these activities, with each subtopic having its set of activities, has contributed to the effectiveness of the assessment.

By making the most of the assessment features integrated into comics, any doubts about the efficacy of assessments conducted without direct teacher involvement may be alleviated. As such, the research findings accentuate the capacity of comics to facilitate assessments that are just as effective as those administered in more traditional teacher-centred methods. Teacher S1T3 further emphasises this point in her statement:

> *Assessment was more effective with comics than with the traditional methods as most of the students performed well in the reinforcement activities given to them. Most of the students managed to provide correct answers after they were taken through the content with the assistance of comics. I have not seen a situation like that before. My students usually struggle with following instructions and do not perform well compared to what they currently did during this instruction. It is exciting to see students solving difficult problems effectively with less assistance.*

The statement above substantiates the effectiveness of assessment within comic instruction by showcasing the positive academic performance of students who completed the designated activities. This holds true if the questions' standard and level of difficulty align with the curriculum guidelines. As a result of its inherent characteristics, comic instruction generates more effective classroom assessment activities compared to traditional methods. Comic activities are designed to be engaging, and the instruction is comprehensive for students, as comics can convey complex information through a few captivating images. This benefits all students in the Science classroom, including those with language proficiency challenges, enabling them to excel and enhance their learning outcomes by facilitating better understanding of assessment instructions.

6.4.5 Finding 5: Practical activities with comics are more effective compared to traditional methods of instruction.

Practical activities are fundamental tools in a Science classroom, enabling students to better internalise scientific knowledge, particularly when laboratory equipment is available and well-utilised. However, the lack of practical equipment in schools often leads teachers to omit practical activities and focus on theory, which is easier to teach. Comic instruction may offer a potential

solution to address the absence of practical activities in Science classrooms, particularly in under-resourced schools. The effectiveness of comic instruction in incorporating practical activities is crucial for students to develop the skills necessary to master the specific objectives of a Science subject when learning with comics. In assessing the effectiveness of comics in practical activities, I asked teachers whether practical activities were more or less emphasised during comic instruction lessons. All teachers expressed a positive view of the practical activities used in conjunction with comic instruction. The following statements support these observations:

> *It came out that comic instructions have the capacity to employ practical activities in the classroom without using any single practical material. Practical activities were effectively engaged with an accurate virtual presentation by the comics. I think this was made possible because students can relate the visual experiments showcased by the comics with the realities. (Teacher S1T1).*

The sentiments expressed above underscore the effectiveness of comic instruction in addressing practical activities in the classroom. This effectiveness suggests that practical activities conducted using comics are more successful than traditional methods. The key factor contributing to the success of comic instruction in handling practical activities is its capacity to virtually present such activities, effectively bridging the gap between the virtual and real world. Given the challenges that Science teachers often face in securing suitable classrooms with laboratory resources, virtual practical activities offered by comics can be a valuable resource, especially for under-resourced schools.

Comics provide students with the opportunity to engage in practical activities virtually, allowing them to experience situations closely resembling real-life experiments without the need for physical laboratories or equipment. The virtual nature of these practical activities can also address the challenges associated with a lack of practical skills and inexperience in handling scientific equipment among Science teachers. In essence, if virtual practical activities within comics are effectively aligned with real experiments and presented clearly through comic characters, comics have the potential to comprehensively cover the requirements of a Science lesson, as expressed by Teacher S1T2.

> *All students were able to observe what was presented by the comics, therefore it was effectively addressed. I mean that the steps were made easier by the comics and that can strengthen the student observation. It is not possible for me to explain practical steps and their outcomes or results without physical materials available in the classroom to demonstrate the procedures. I think comics have done it so well.*

The narrative above highlights that comics provide a concise and clear presentation of practical activities, allowing students to easily follow each step and understand the abstract phenomena being addressed in the activity. Comics serve as an effective tool for illuminating these abstract concepts within practical activities, benefiting students who may not be proficient in the language of instruction. The expressive body language and visual cues used in comics, whether in video- or book-mode, offer an added value to the Science classroom compared to traditional teaching methods. Even if students encounter language difficulties, they can still observe and comprehend the concepts presented through the practical activity.

The succinct and engaging presentation style of comics also enhances student interest, which is crucial for increasing their involvement in the subject matter and facilitating effective knowledge and skill acquisition. One of the teachers observed the heightened interest of students in practical activities with comics, as indicated in the narrative provided.

> *Practical activities were one of the interesting parts of the comic instruction. The aims of the practical activities were effectively addressed, and students were more interested to see what was happening. I was impressed by the way students were behaving. They were quiet, listening attentively [observing] and showing the maximum interest in the subject. Some students who finished reading the book-mode comics in a short time, took it up by themselves to repeat the reading once more again. Such behaviour does not happen when they are reading ordinary texts. (Teacher S1T4).*

The statements emphasise that comics have the ability to enhance student interest and facilitate their understanding of practical procedures. Comics provide students with a visual and often auditory representation of the practical activity, allowing them to make sense of the procedures involved. Video-mode comics, in particular, leverage both visual and auditory elements, while book-mode comics use body language and speech bubbles to convey information. This multimodal approach appeals to a broader audience, making the content more engaging.

The inherent appeal of comics, characterised by their visual richness and storytelling elements, captivates students' interest. As a result, students are more attentive and fully engaged during practical lessons when comics are used compared to traditional teaching methods.

6.5 Theme 2: Both teachers and students encounter challenges when implementing comic-based instruction in the science classroom.

Additionally, this study aimed to uncover the challenges faced by teachers and students in the process of creating comics, as well as in teaching and learning with comics. Understanding teachers' hesitancy to adopt comic instruction is a key aspect that requires investigation. Identifying the potential barriers that prevent teachers from embracing comic instruction is crucial, as regular utilization of comic-based instruction in Grade 4 Science classrooms has the potential to enhance students' understanding of scientific concepts, regardless of their proficiency in the language of instruction. This knowledge can aid in addressing these challenges and promoting effective comic instruction in science education.

6.5.1 Finding 6: Teachers face challenges (lack of skills, training, resources, and time constraints) during the preparation of comics.

In the previous section, the study's findings shed light on the absence of comics in Namibian classrooms and elucidated the underlying reasons for this dearth. In this section, the focus shifts to investigating the challenges that teachers and students are likely to encounter when using comics. It is important to note that these challenges may overlap with the reasons behind the underutilization of comics in classrooms. By unveiling and addressing these challenges, education stakeholders, including the Ministry of Education, education directorates, and universities, can better prepare for the implementation of comics in Namibian schools. Raising awareness of the challenges associated with the introduction of comics in classrooms can alleviate the burdens faced by teachers when preparing comic-based lessons. Throughout this study, teachers were asked to identify and describe the challenges they faced during the preparation of comics, and the following narratives serve as evidence of these challenges:

> *I cannot prepare comics to be used effectively in the classroom. I am not in the position of producing the comics at this moment. I can only do it [prepare comics] when I am trained to do so. The lack of skills in comics is a challenge and it is hindering us, teachers, to prepare our lessons using comics. I think when we receive the training, we can be comfortable, and be able to participate in preparations of comics. (Teacher S2T3).*

The quoted passage highlights the significant challenge of inadequate training and the lack of essential skills when it comes to producing comics in schools. Many teachers graduate from universities without receiving any formal training in comic instruction. This lack of training can make it difficult for teachers to create high-quality and impactful comics for classroom use. Without the proper training, teachers may struggle to understand what is expected of them and may lack the necessary skills required to produce effective comics.

While some teachers may have natural talents in drawing or acting, these talents alone may not be sufficient to produce comics that enhance learning outcomes. Training in comic instruction not only provides teachers with the knowledge they need but also boosts their confidence and motivation to use comics effectively in the classroom. It is important to recognise that teachers who receive training and preparation in comic instruction are more likely to create high-quality comics compared to those who attempt it without the necessary skills and knowledge.

Moreover, the lack of information about comics due to the absence of university training can lead teachers to believe that comics can only be created by artists or individuals with acting abilities. This misconception can further deter teachers from embracing comic instruction, as evidenced by the statement made by Teacher S1T1.

> *I'm not an artist, [so] I cannot draw [the cartoons for the book-mode comics]. I think someone needs to be fun so that he/she is able to act [to produce video-mode comics]. I need to find a person who can draw or act in the video comics but to get someone from somewhere to help me in that regard requires funds…*

The passage highlights a key issue: teachers' lack of knowledge and information about comics, which leads them to perceive creating comics as impossible if they cannot draw or act in video comics. This perception creates a barrier to the adoption of comic instruction. Teachers may

believe that the only solution to overcome the challenge of lacking drawing and acting skills is to find someone with such skills to produce comics on their behalf.

However, if teachers were exposed to comics during their university years, they might be aware of the availability of comic software packages that can be purchased online. These software packages can be used to create comics even if one lacks drawing or acting skills. Nevertheless, it is important to note that using comic software packages also requires skills and knowledge on how to use them effectively.

In addition to skills and knowledge, teachers mentioned time constraints as another challenge in preparing comics. This suggests that even if teachers had the skills and software tools, they may still struggle to find the time needed to create comics. Addressing these challenges, such as providing training and resources, could potentially encourage more teachers to embrace comic instruction.

> *Many teachers are overcrowded. We don't have time to do extra things on top of what we are currently doing. Like myself, I do not have time to prepare comics. To produce quality comics, there needs to be a collaboration between teachers. Therefore, time to do such an activity needs to be availed so that teachers could travel from different destinations. But time is not there at all.* (Teacher S2T2).

The narrative above highlights the significant challenge of time constraints faced by teachers in preparing comics. Creating comics requires patience and a considerable amount of time to ensure the quality and effectiveness of the final product. This can be particularly challenging for teachers who are already overloaded with various responsibilities, such as lesson planning, classroom management, and grading assignments.

In addition to time constraints, the lack of necessary resources in the classroom, including financial resources and technological devices like computers, printers, television, and internet connectivity, is identified as another obstacle to comic preparation. These resources are essential for producing both video- and book-mode comics.

Insufficient resources can hinder teachers from effectively creating and using comics as instructional materials. Without access to these resources, teachers may struggle to develop high-quality comics that align with the curriculum and are engaging for students. Addressing these resource challenges is crucial for promoting the use of comics in the classroom and ensuring that they are a viable and effective teaching tool.

> *Challenges [facing teachers when preparing comics] are lack of finances to buy printers, computers and television…We don't have computers in the school. The laptop we are currently using is for the principal. The small printer we have cannot cater for all the printing work we already have, so adding the comics' production would be a burden. The absence of television at our school is a problem too. And it is like the smart television is the best because you only need a memory stick to play the comics that are saved there.*

The narrative above underscores the challenges faced by schools that lack essential resources such as computers, printers, televisions, and internet connectivity, which are crucial for comic production and utilization. Limited financial resources often prevent schools from acquiring these devices, thereby hindering the implementation of comic instruction.

To address these challenges, schools require sufficient funding to invest in the necessary equipment and infrastructure for comics' production. For the creation of book-mode comics, access to computers, colour printers, and internet connectivity is essential, while video-mode comics production relies heavily on televisions and video cameras.

The absence of internet connectivity not only affects comic production but also limits access to pre-made cartoons and comic software packages. However, alternative solutions, such as collaborating with local photographers and utilising personal resources like bringing a television from home, can help mitigate these challenges and enable the implementation of comic instruction in schools.

The schools did not have enough computers for the teachers to use, teachers utilised their smartphones to access the internet by means of a personal mobile hotspot connection provided by my pocket Wi-Fi device. The narratives provided by Teachers S1T1 and S1T4 underscore the challenges related to internet access and printing in colour during the production of book-mode

comics. Printing in colour can be costly, and many schools may not have access to printers, making it inefficient to rely on printing shops in the township. In response to these challenges, you brought a dedicated printer and laptop to the study sites to facilitate the production and printing of book-mode comics. This effort aimed to overcome the obstacles associated with limited internet resources and expensive colour printing, ensuring the successful execution of the study's comic instruction component.

> *First of all, we don't have a big printer to cater for comics printing. And to make matters worse, the printer cannot print in colour. I just learned that comic books need to be printed in colour, and it is very expensive. I cannot afford, and the school cannot afford to print comic books enough for every [learner]. The whole thing is just too demanding as finances are concerned.* (Teacher S1T1)

> *It is very difficult! We don't have much to use when it comes to the preparations of comics. The lack of resources like finances and no access to the internet are one of these issues… Like how can I prepare the cartoons ready to use in class if I can't draw? I cannot draw even a simple picture. I have to look for someone to draw the cartoons for me…and these are all the challenges affecting the preparation of comics.* (Teacher S1T4)

The narratives above emphasise the financial challenges, particularly the lack of funds for essential devices such as computers, colour printers, and internet connectivity. Teachers expressed their concerns about the inadequacy of financial provision to schools, which hinders their ability to acquire the necessary resources for efficient comic preparation. These challenges contribute to the rarity of comic instruction in under-resourced classrooms, highlighting the need for increased financial support to provide the essential resources for effective comic-based teaching and learning.

6.5.2 Finding 7: Teachers face challenges (reading difficulties with students and insufficient time) during teaching presentations with comic instruction.

Although teachers found it challenging to prepare comics for teaching Science, they generally reported no significant challenges when actually using comics as a teaching tool. This aligns with the principles of Bandura's Social Learning Theory, emphasising the role of symbolic representation in learning. When teachers only need to be partially involved in the lesson presentation, with comics taking over most of the teaching responsibilities, challenges during the

teaching process are minimized. During the study, teachers had a passive role as comics presented the lesson, conducted assessments, and facilitated practical activities, while the teachers observed silently. Therefore, most teachers felt that as long as the comics were adequately prepared, teaching with comics posed no significant challenges. When asked about their experiences with teaching using comics in the Science classroom, the following response supports this perspective:

> *Honestly, I did not experience any challenge while the comics were presenting the lesson to the students. If everything is prepared and all comics are ready to use, then there will be no problem teaching with comics. Teachers would not face challenges during the comics' presentation because there is nothing for them to do except maintain order and discipline in the classroom.* (Teacher S2T1).

These statements emphasise that, in general, teachers did not encounter significant challenges when delivering lessons using comic instruction. While most teachers reported a smooth teaching experience with comics, Teacher S1T4 mentioned specific challenges related to addressing slower students and dealing with reading difficulties among students during comic instruction.

> *The only thing I can highlight on that is the reading with the understanding problem. If a majority of [learners] cannot read with understanding, then it becomes a burden for the teacher, and that would force him/her to go beyond using comics. Slower students may need more explanation from the teacher and not only read from the comic books and understand the subject matter by themselves. They may need a teacher to explain more and more before understanding because they have a problem with reading.*

This statement highlights the challenge teachers face when using comics with slow students and students with learning difficulties. Teachers found it challenging to adapt the comic instruction to meet the specific needs of these students, such as providing additional explanations, drilling, and scaffolding. Additionally, comics cannot easily identify students who are struggling or taking longer to grasp concepts, making it difficult to provide targeted assistance. For instance, book-mode comics may not be as effective for students who cannot read compared to video-mode comics. Furthermore, time constraints were mentioned as another challenge teachers encountered when using comics for instruction. The response confirming the time constraint challenge is as follows.

> *Time is too short for video-mode comics. To make sure the setup of equipment needed to present the lesson to the students, needs time. Some lessons are too short, except when we*

> *have double lessons. Preparing video comics perfectly fitting in the given time allocated to the lesson might be challenging. (Teacher S1T2).*

The narrative above highlights that some teachers believe that there isn't enough time to effectively present video comics in the classroom. Video-mode instruction requires adequate time to show longer videos without interruptions, and the setup process for devices can also consume valuable teaching time. Additionally, the lack of flexibility in comics to promptly adapt to changes during a lesson was mentioned as a time-related challenge. Anything that adds extra time and effort in the classroom when using comics could deter teachers from implementing comic instruction.

6.5.3 Finding 8: Students face challenges (student laziness, lack of interest, and comics illiterate students) when they are learning with comics.

Students were provided with book-mode comics for self-paced reading, while those engaging with video-mode comics on television had the pace of learning determined by the video presentation. In the case of video-mode comics, students sat in front of the television and followed the comic's presentation independently, without teacher involvement. Remarkably, students demonstrated high levels of attention and active participation in the lesson, regardless of the comic mode. Consequently, when teachers were asked about challenges encountered by students during comic-based learning, only a few teachers reported experiencing any of these challenges when observing students using comics. The following quote supports these observations:

> *Actually, I did not experience any challenge with the [learners], they were actively involved in the lessons. The whole class was passionately following both videos and books without any disturbance. [Learners] were comfortable, so not even a single one of them showed some signs of disorientation or confusion of what was supposed to happen. (Teacher S1T2).*

The preceding accounts highlight that certain students did not exhibit any apparent challenges while engaging with comics for learning. This lack of apparent difficulty may be attributed to the students' heightened attention and active engagement with the subject matter, potentially leading teachers to believe that no challenges were present. However, it is essential to recognize that even students displaying keen interest and active participation may still face underlying challenges that could impact their performance when using comics as an instructional tool.

Consequently, Teacher S1T1 identified some of these challenges affecting students in the context of comic-based learning and stated:

> *Some [learners] may not see comics as fun and they would want to learn while reading ordinary books with fewer pictures. Some [Learners] may not like cartoons at all, and that might contribute to withdrawal from the lessons. Another problem is that comics will make students adjust themselves because they are not used to the new method. Furthermore, some students may not like reading, so they might be challenged when reading book comics without a teacher explaining the subject matter (Teacher S1T1).*

The statement above explains the potential challenges that students may encounter while learning Grade 4 science through comics. It becomes evident that not all students can fully embrace or effectively engage with visual materials such as cartoons or pictures as a primary mode of learning. For instance, auditory learners prefer acquiring knowledge through hearing and listening, storing information based on how it sounds. They may gravitate toward a teacher's verbal explanations over purely visual content, particularly in the case of book-mode comics, which lack sound. Consequently, an overreliance on comics might lead to disinterest and boredom among such auditory learners.

Moreover, some students may require an adjustment period when transitioning from traditional teaching methods to new approaches like comics, potentially hindering their initial understanding and learning outcomes. In this context, a lack of comic literacy could have a detrimental effect on their academic achievements. Additionally, students who need help with reading may need help comprehending the content presented in comics, particularly in the absence of a teacher to provide explanations or guidance. The following narrative further corroborates the claim of reading-related challenges.

> *Some [learners] would be only interested in viewing the pictures without reading, especially those who cannot read. We have many Grade 4 [learners] who cannot read as yet. Giving these [learners] comic books would not assist them if the teacher is not teaching. (Teacher S2T1).*

The issue of reading difficulties with book-mode comics extends beyond students who are unable to read and may also impact students who possess reading skills but exhibit tendencies of laziness or simply harbour a dislike for reading. As Teacher S3T1 noted:

> *Students who don't like reading maybe follow pictures without reading and those watching TV may just look at pictures without listening. Students who don't like reading could be part of those who finished in fewer minutes of the time allocated to the lessons. They did not read the texts in the speech balloons, but only enjoyed looking at the colourful cartoons.*

Teacher S2T2 aligns with Teacher S3T1, identifying laziness as another challenge related to reading in the context of learning with book-mode comics. Regarding this issue, Teacher S2T2 mentioned:

> *The challenge [with learning with book-mode comics] is just reading, as many students do not know how to read. Lazy ones may not also learn effectively [with book-mode comics] Lazy [learners] are those who know how to read but have no desire to read. Lazy [learners] may omit some important information in the comic books as they will be just paging without proper reading.*

The narrative underscores the reading challenges impacting Grade 4 students when it comes to comic instruction, suggesting that some students might advance to Grade 4 without achieving competence in reading. This situation could be influenced by Namibia's promotion policy, where students who fail the junior primary phase twice are promoted to Grade 4, even if they lack basic reading and writing skills. Consequently, these students may find video-mode comics more effective than book-mode comics, unless guided by a teacher. For those who can read and write but still struggle to engage with the comic instructional method, the issue may be linked to a form of comic illiteracy. This implies that for comic instruction to be effective, students must not only possess general literacy skills but also be well-versed in comic literacy, which applies to both book-mode and video-mode comics, as Teacher S4T1 highlighted:

> *I think the problem with those students who might have a tough time understanding the comics is because of the difficulty in comics' language. The comics' language is a problem, especially for students from villages. Students from towns are better because they watch TV at home, and they have a good understanding of comics than those from the villages.*

The narrative highlights the influence of location on comic literacy, specifically the contrast between students from urban areas and those from rural villages. Urban students, accustomed to

watching cartoons on television, appear to benefit more from video-mode comics than their rural counterparts. Consequently, students who lack exposure to television cartoons may be at a disadvantage. Addressing the identified challenges, ranging from reading difficulties to engagement and comic literacy, is crucial to enhancing the effectiveness of both comic modes. Notably, comic literacy can play a vital role in enabling students to learn science effectively, irrespective of their proficiency in the English language.

6.5.4 Finding 9: Experts in educational comics' production are not available in the communities concerned.

Teachers cited their inability to create comics because of the shortage of skills, resources, time constraints, and the lack of internet connectivity within schools. To overcome these challenges, one potential solution is to engage community experts who can produce comics for use in teaching. To ascertain the presence of skilled individuals within the community who could aid teachers in comic production, I inquired whether the teachers were aware of any cartoon animators or video makers in their locality. Additionally, they were asked to specify the number of comic experts in the community. However, all participating teachers confirmed that they were unaware of any animators or video makers in their community. This response provides further validation of the stated claim.

> *I don't know anyone who can do that. There is no one at all. I have never seen cartoon images drawn by any member of this community on whatever platform or for whatever entity. Like now, I don't even know where to go if I happen to need comics to use in my class. (Teacher S2T2).*

This narrative highlights the significant challenges teachers face in attempting to engage experts or individuals with the necessary expertise for the production of both video- and book-mode comics, which are essential to realising the potential of comic-based instruction. The creation of video-mode comics demands expertise in filmmaking, proficiency with video cameras, and video-making software, or competence in animation. In contrast, book-mode comics require someone skilled in drawing or well-versed in using comic software packages. Comic illustrations can be crafted by hand or with the aid of tools like drawing pads such as the *Wacom©*, which are available

in electronics stores. Consequently, if teachers lack artistic capabilities, individuals with drawing skills or experience with illustration devices could provide invaluable assistance. In the absence of available experts in comic production, teachers who lack creativity or experience in producing comics as a teaching method find themselves with limited options, often resorting to traditional teaching methods when instructing students in Science.

6.6 Theme 3: The challenges facing teachers and students could be addressed after employing some mitigation strategies on the employment of comics.

This study has shed light on the potential of comics as an effective tool in Grade 4 Science classrooms while also uncovering several challenges that may impede their widespread adoption. To facilitate the successful implementation of comic instruction in Science classrooms, this section outlines a series of mitigation strategies that aim to overcome the obstacles hindering its usage. These strategies are designed to address challenges related to comic preparation, teaching and learning with comics, and the limited utilization of comics in Namibian schools.

6.6.1 Finding 10: The challenges associated with the preparation of comics can be addressed by training from local institutions of higher learning; provision of finances and comic books from the Ministry of Education; and comics workshops and seminars from regional directorates of education.

The challenges associated with preparing comics for instructional purposes must be effectively addressed to ensure the efficient use of comic instruction in the classroom. The participating teachers have provided valuable insights and proposed strategies to overcome these challenges. Their suggestions emphasise the importance of collaboration between the Ministry of Education, schools, and teachers to create a conducive environment for comic preparation and implementation.

To address these challenges, the teachers recommend that the Ministry of Education take an active role in providing necessary funds and training in comics for all teachers. Additionally, they suggest that schools invest in essential technological devices such as computers, televisions, and internet connections to support the production and use of comics in the classroom. These

proposals accentuate the need for comprehensive support and resources to make comic instruction a practical and effective teaching method in Science education.

> *It can only be addressed if the government provide more resources to the schools like computers, tablets and internet provisions. Teachers should be trained at university on how to come up with comics before they graduate. Schools with trained teachers and the provision of financial resources in place would introduce comic instruction effectively. It needs a strong collaboration between all the stakeholders in education. (Teacher S1T3).*

Teacher S1T3 agrees with Teacher S1T2, who said:

> *The Ministry of Education must come up with workshops on comics. Schools should consult other schools that are using comics to explain how they go about it. Teachers need to further their studies to improve their computer skills. The ministry should release funds earlier, at the beginning of the year, so that schools can purchase resources needed in comics' production.*

These narratives shed light on the mitigation strategies put forth by the participants to tackle the challenges that may hinder the implementation of comic instruction, particularly in terms of comic preparation. The participating teachers suggest several measures, including universities offering educational courses to train teachers in comic instruction, the Ministry of Education providing financial support and necessary resources for comic instruction such as comic books, cameras, televisions, computers, and internet connectivity, and regional education directorates organising workshops and seminars on comics. Addressing these concerns related to comic creation will empower teachers to effectively prepare book-mode and video-mode comics or acquire pre-designed ones for their students in the Science classroom.

6.6.2 Finding 11: Teaching and learning challenges with comics can be addressed when every student has an opportunity to watch cartoon programmes on television at school; remedial teaching in reading is employed; different reading programmes are in place at school; and the language policy is revisited so that there is no transition in the language of instruction between phases.

Teaching with comics presents several challenges, including the inability of comics to provide drilling and scaffolding for learning, the lack of flexibility in adjusting to individual student learning paces, time constraints, and potential challenges related to reading skills, comic literacy, and

individual preferences. Addressing these challenges is crucial for the successful implementation of comic instruction in the Science classroom.

In response to these challenges, the participating teachers offered potential solutions and strategies to mitigate them. Their insights and suggestions are valuable in ensuring that comic-based instruction can be effective and accessible to a wide range of students. These solutions may include creating supportive learning environments, offering additional resources, providing remedial support for reading skills, and promoting visual literacy. The collaborative efforts of teachers, schools, and educational authorities can contribute to overcoming these challenges and making comic instruction a viable and successful teaching method in Science education.

> *Teachers need to make students aware of the comic methods. Teachers need to help them get used to the comics' language by watching entertaining cartoons on television. Teachers should create a conducive environment to show educational comics and deal with the timetable to know when to show video-mode comics. This will give us enough time designed to fulfil comics needs as per the syllabus. We also need to make sure that what we are showing is fun to the [learners] (Teacher S1T1).*

These statements highlight potential strategies for mitigating the challenges faced by both teachers and students when using comics as an instructional tool. The participating teachers in this study recognised the importance of students being literate in comics and having the skills to interpret them effectively. They stressed the significance of visual literacy, a subset of comic literacy, as a skill that all students should develop before using comics for learning.

To enhance visual literacy and familiarity with comics, schools could create opportunities for students to watch comic films on television. These comic films could be particularly beneficial for students who do not have access to televisions at home. However, teachers must ensure the learning environment is conducive when using video-mode comics. Providing a secure and disturbance-free room and considering factors like volume and sound quality during comic presentations can help students fully engage with and understand the content, as there may be limited opportunities for additional explanation or clarification.

In addressing reading challenges, Teacher S1T4 shared insights, which could involve implementing remedial reading strategies and providing support to students who struggle with reading in the transition from one language of instruction to another, such as from a local language to English. These strategies aim to improve students' reading skills and ensure they can effectively access and benefit from comic-based instruction.

> *Schools must come up with ways to see how the students who cannot read could be assisted. On my side, I would try to have extra classes to help students who are struggling with reading so that they can cope with learning with comics with not much teacher help. The extra classes would be made effective if I get hold of the reading programmes for children.*

The narrative emphasises the significance of addressing reading challenges before introducing comic instruction, particularly book-mode comics. To tackle reading problems, teachers may need to implement remedial reading strategies tailored to individual students' needs. Motivating students to develop an interest in reading is also crucial, recognising that students may have varying levels of reading ability and interest.

In Grade 3, it is important to expose students to a variety of reading resources to cater to their diverse interests. This could include not only books but also magazines and newspapers, providing students with different opportunities to engage with reading materials. Additionally, teachers should pay attention to the language in which students face more severe reading challenges, as language transitions can significantly impact students' reading abilities, as mentioned by Teacher S2T1. Addressing language-related reading difficulties is essential for effective learning, especially when transitioning to a new medium of instruction.

> *The problem is that government schools' students are taught in Oshiwambo from pre-primary to Grade 3, while students from private schools are taught in English throughout. Students must be taught in English as from lower grades so they would catch up in Grade 4. As long as English is the official language, and it is used in all departments of government, it should be used as a medium of instruction from pre-primary so that students could be proficient as early as possible. (Teacher S2T1).*

The comment highlights a significant challenge related to the language of instruction in Namibian schools. The reading challenge arises from the practice of teaching in the Oshiwambo language

from pre-primary to Grade 3 and then switching to English as the medium of instruction from Grade 4 onwards. This language transition can pose difficulties for students, particularly when it comes to reading and comprehending English-language materials. Teacher S3T1 succinctly describes this challenge, shedding light on the language policy's impact on students' reading abilities.

> *I think students in junior primary [pre-primary – Grade 3] are only used to reading in Oshiwambo due to the language policy. They have a habit of not liking or wanting to read in English when they come to Grade 4. I think if the medium of instruction in junior primary is to be changed from its current status, then it can address this problem.*

The narrative above highlights an important aspect of the reading problem faced by students. While children may have acquired reading skills in the local language, which serves as the medium of instruction in the junior primary phase, they may not be inclined to learn to read in English when they transition to Grade 4, where English is the medium of instruction. This transition can pose a significant challenge when implementing comic instruction as students may struggle to read and comprehend English-language comics.

Teachers are suggesting that a potential solution to this issue could be to ensure consistency in the language of instruction throughout a student's early education. Alternatively, if a change in the medium of instruction is necessary, they propose lowering the transition grade to Grade 3 instead of Grade 4. This adjustment aims to provide students with more time to adapt to English as the medium of instruction, thus potentially alleviating reading-related challenges when using comic instruction.

> *Maybe in Grade 3, we try to teach in English, [or] the transition to English to happen in Grade 3. Learning in Oshiwambo from pre-primary to Grade 2 could be enough. Four years of learning all the subjects in Oshiwambo and changing to a foreign language is not doing the children any justice. Transition to English should start in Grade 3 so that English foundation is laid earlier in schooling life. (Teacher S2T3).*

The statement above highlights a strategy to address the reading problem in Grade 4 by introducing English as the medium of instruction at an earlier stage. While this initiative may help resolve the issue in Grade 4, it could potentially shift the reading problem to Grade 3, which could

still hinder the learning of science concepts in that grade. Any strategy devised by teachers and schools to tackle the reading problem should ensure that the majority, if not all, of the Grade 4 students can read proficiently. This entails implementing reading programs and interventions in Grades 1-3 to ensure that most students are capable of independent reading before entering Grade 4.

Furthermore, participating teachers expressed the need to revisit the language policy that mandates local languages as the medium of instruction in lower grades, especially since these languages are predominantly spoken in the community. Re-evaluating this policy could promote English language proficiency at an earlier stage, facilitating more effective reading of English words in science subjects and enhancing the efficacy of comic instruction.

6.6.3 Finding 12: Minimal use of comic instruction in Namibian classrooms should be addressed by increased internet coverage, provision of physical resources like printers and computers, training, and motivating teachers to go the extra mile during teaching and learning.

Teachers have indicated the absence of comic instruction in Namibian classrooms, attributing this to various factors such as insufficient funds, equipment, internet access, training, and drawing skills. To address these challenges and promote the use of comics in education, it is essential for the government to ensure that all schools receive adequate support and resources necessary for producing comics, especially if readily-made comics are not distributed. When asked about the limited utilisation of comic instruction in Namibian classrooms, participating teachers provided the following reasons:

> *Government should provide computers and internet connection to schools, [and] come up with programmes to train teachers on comics. The government could also make sure that comic books are available and distributed to all schools in all regions. (Teacher S1T2).*

This narrative highlights that the availability of computers, along with well-trained teachers who have internet access, could facilitate the production and accessibility of comics in schools. To make comics readily available, other essential materials include printing supplies for creating book-mode

comics. Teacher S3T1 emphasised the importance of having access to paper and ink for producing comics, stating:

> *The Ministry of Education through the regional directorate of education should provide enough materials for printing like papers and inks. Motivation sessions are to be used to address lazy teachers. Lazy people [teachers] would not want to try out things, because they are comfortable, and they avoid going the extra mile. (Teacher S3T1).*

This narrative sheds light on the perceptions of teachers regarding the limited use of comics in Namibian schools and proposes strategies to address this issue. The participants also put forth a strategy to motivate teachers to embrace new methods and diversify their teaching approaches. Addressing these concerns would not only enhance the current situation but also encourage more teachers to incorporate comics into their classrooms. Therefore, participating teachers emphasise the need for providing schools with comic materials, financial support, and internet access. Additionally, they advocate for comprehensive training in comic instruction at the university level and organising workshops for teachers already in the system to equip them with the necessary skills and knowledge. Lastly, it is crucial to motivate teachers to explore various teaching methods, including comic instruction, by fostering their enthusiasm and energy for innovative teaching approaches.

6.7 Conclusions

This chapter primarily delves into the qualitative data derived from the study. It offers insights into the perceptions of the participating teachers regarding the effectiveness of comics as an instructional tool, the challenges impeding comic instruction, and the suggested strategies to mitigate these challenges. To conclude, this chapter synthesizes the study's findings, drawing comparisons with relevant references from the existing literature.

6.7.1 Finding 1: There is little to no comic instruction in the teaching of primary Science.

Teachers disclosed that adopting comic instruction in Namibian schools faces numerous impediments, including the absence of drawing skills and time constraints. These findings are in alignment with the research of Muyassaroh, Asib, and Marmanto (2019), who identified specific

challenges that teachers encounter when integrating comics into their teaching practices. These challenges encompass teachers' difficulties producing comics and concerns about managing time effectively (Muyassaroh et al., 2019).

Moreover, Morrison et al. (2002) observed a general reluctance among teachers to incorporate non-traditional educational resources, such as films, comic strips, contemporary music, and other popular media, into their classrooms. According to Morrison et al. (2002), teachers express apprehensions that these alternative methods of instruction might not afford students sufficient time to engage with the subject matter adequately.

6.7.2 Finding 2: Teachers experience comic instruction as more effective in the teaching of primary Science than traditional methods of instruction.

Teachers found that comics are highly effective in the Science classroom because they can arouse interest and are comprehensible to students as they listen attentively. The act of students actively listening is an integral component of the observational process. Before they can successfully replicate modelled behaviour, it is imperative that they observe it closely before they imitate. It is through this process of imitation that students gain a comprehensive understanding of scientific concepts. This emphasises the fact that the imitation of learned behaviour cannot occur passively. In accordance with Albert Bandura's Social Learning Theory (SLT), learning is a social phenomenon that transpires through the active observation and subsequent imitation of others' behaviours (Sutton, 2021). Consequently, the term "listening" can be interchangeably used with "observing" in this context.

Additionally, the study revealed that comics have the capacity to enhance memory retention and bridge the gap between imagination and reality. These findings resonate with the research conducted by Koutnikova (2017) during a year-long project that explored the impact of comics on students in a preschool teacher training program. Koutnikova's work demonstrated the high effectiveness of comics in rendering science concepts both engaging and comprehensible for primary school children.

Dalacosta et al. (2009) also support the idea that animated cartoons, like comics, are highly effective in improving young people's grasp of challenging science concepts, which are often sources of misconceptions among students. Furthermore, Jee and Anggoro (2012) found that comics significantly boost comprehension and aid memory retention among students. According to Affeldt et al. (2018), this improved comprehension occurs because comics have the unique ability to transform what is typically imagined into a tangible reality.

6.7.3 Finding 3: Students pay more attention to comics than to traditional methods of instruction.

Comic instruction has been shown to improve students' attention span in the classroom, addressing a common challenge faced by Science teachers (Hadzigeorgiou & Schulz, 2019). This finding aligns with the observations made by Nashir et al. (2021), who emphasise the role of positive communication in enhancing student attention and fostering subject appreciation, which can be achieved through educational comics. Effective communication, a key aspect of student engagement and attention, is facilitated by the humour, narrative, and visual elements inherent in comic books (Lin et al., 2015).

Moreover, Spiegel et al. (2013) highlight the potential of educational comics to spark interest among students, particularly those with limited prior interest in the subject. Their research underscores that presenting science content in a comic format not only piques student interest but also serves as a motivating factor. This perspective on student motivation and engagement during comic instruction is corroborated by the work of Syarah et al. (2019) and Rahayu et al. (2021), who argue that students actively pay attention and engage in the learning process due to the interactive and real-life application of comics in teaching.

6.7.4 Finding 4: Comic-based assessment activities are more effective compared to traditional methods of instruction.

The findings highlight the effectiveness of comic-based assessment activities compared to traditional assessment methods. This aligns with the findings of Song et al. (2008), who suggest that comics can serve as a highly effective alternative to traditional assessment approaches. The

idea of using comics for assessment is further supported by the work of Perales-Palacios and Vilchez-Gonzalez (2005) and Naylor and Keogh (2013), who emphasise that comics can not only enhance classroom engagement and motivation but also serve as a valuable tool for formative assessment.

6.7.5 Finding 5: Practical activities with comics are more effective compared to the traditional methods of instruction.

The findings of this study underscore the effectiveness of practical comic activities compared to traditional methods that lack laboratory equipment. These results are consistent with previous research, particularly the findings of Affeldt et al. (2018), who contend that comic-based experimental instruction is highly effective, as it leads to very positive student perceptions by visualising scientific tasks and connecting them to real-world situations. This aligns with the assertion made by Koutnikova (2017) that visually representing scientific ideas through comics in experiments and practical activities enhances students' understanding of scientific concepts. Therefore, comic-based instructions are more advantageous in practical activities than conventional teaching methods.

6.7.6 Finding 6: Teachers face challenges during the preparation of comics.

The findings of this study highlight the challenges faced by teachers in the process of preparing comics, which include a lack of drawing and acting skills, limited training, time constraints, and insufficient access to necessary resources and devices. These findings resonate with the results of a prior study conducted by Akcanca (2021), which sought to explore the perspectives of prospective teachers regarding the design of comics for science education. Akcanca (2021) reported that prospective teachers encountered difficulties in aspects like drawing, creating backgrounds, and achieving a harmonious integration of text and images within cartoons. In addition, these prospective teachers also faced limitations related to the availability of technological devices.

Similarly, Avarogullari and Mutlu (2019) identified challenges associated with comic instruction, including teachers' lack of prior experience with comics, inadequate knowledge and practical skills,

and difficulties in aligning content suitability with grade levels. Avarogullari and Mutlu (2019) also highlighted the labour-intensive nature of comic production, which can be time-consuming.

6.7.7 Finding 7: Teachers face challenges during teaching presentations with comic instruction.

The study identified several challenges associated with teaching using comics, including the need to address slow students and students with learning difficulties. Additionally, time-related constraints emerged as a significant challenge. Teachers reported that they often lacked sufficient time when incorporating comics into their teaching compared to traditional instructional methods. This finding aligns with previous research, which has also highlighted similar challenges encountered in the implementation of comic instruction in science classrooms.

For instance, Trnova et al. (2013) revealed that certain students may require tailored guidance and support from teachers to grasp the subject matter effectively. This need for guidance is particularly pronounced for students facing interdisciplinary skill requirements encompassing science knowledge and skills, mother language, art, ICT, and English. These challenges are especially relevant for students who struggle with reading or have learning difficulties. Moreover, Muyassaroh et al. (2019) noted that teachers have expressed concerns about time management issues when presenting video comics to students, a sentiment supported by Morrison et al. (2002), who found that teachers often contend with time constraints due to their belief that students still require extensive drilling to fully comprehend the subject matter.

6.7.8 Finding 8: Students face challenges when they are learning with comics.

The findings reveal several challenges that students encounter when learning with comics, including reading-related difficulties, varying levels of interest among individuals, and disparities in comic literacy. These observations align with the assertions of Mcvicker (2018), who emphasises the importance of visual literacy in today's technology-driven world. Mcvicker contends that individuals must acquire visual literacy skills early on, enabling them to comprehend visual elements intertwined with text. Consequently, students who lack visual literacy skills may struggle to understand comics, potentially leading to disinterest in the medium and decreased engagement with the subject matter.

This perspective is further corroborated by the idea that students accustomed to watching television, particularly those residing in urban areas where comics hold significance, tend to have a more favourable experience with visual content. In the context of Grade 4 students' reading challenges, as discussed by Trnova et al. (2013), being prepared to learn from comics entails adopting an interdisciplinary approach. This approach necessitates proficiency in both visual and textual literacy to effectively derive meaning from comics.

6.7.9 Finding 9: Experts in educational comics' production are unavailable in the communities concerned.

The study uncovered a notable absence of comics' illustrators or actors within the community where the research was conducted. This scarcity of comic creators in local communities aligns with findings by Melloul (2016), who identified 27 challenges and opportunities within the comic industry. One of these challenges pertains to the limited number of independent creators who have achieved recognition in the comics' market and can serve as role models for emerging talents. In the absence of such role models, many communities lack individuals with expertise in animation and video comic production.

Although the majority of comic creators are traditionally artists, various studies, including those conducted by Artigliere (2016), Meyers (2014), and Shively (2011), have highlighted that anyone can utilise comic creator software such as Comic Life, Pixton, and Ink-Do Comics, respectively, to craft comics. Consequently, the dearth of comic creators in communities often signifies a lack of awareness regarding the existence and accessibility of these software tools. This knowledge gap could potentially hinder community members, including teachers, from actively participating in comic creation.

6.7.10 Finding 10: Challenges associated with the preparation of comics could be addressed by training from local institutions of higher learning; provision of finances and comic books from the Ministry of Education; and comics workshops and seminars from regional directorates of education.

The findings suggest various strategies to address the challenges identified in this study. These strategies include advocating for the Ministry of Education to allocate sufficient funds and provide

training, encouraging schools to invest in technological devices, urging universities to offer courses on comics, and recommending that regional directorates organise workshops and seminars. These proposals aim to facilitate teachers' ability to prepare comics with minimal obstacles. In line with these recommendations, Avarogullari and Mutlu (2019) emphasise the importance of training pre-service and in-service teachers in the use of comics within the classroom context. They suggest that training institutions should design courses specifically focused on comic instruction to equip teachers with the necessary knowledge and skills.

Furthermore, Avarogullari and Mutlu (2019) highlight the value of collaboration among teachers in producing comics for classroom use. They propose that teachers should work together to create comics that can enhance their teaching materials. Additionally, Avarogullari and Mutlu (2019) recommend that policymakers ensure the publication and distribution of comic books to schools, making them accessible to both teachers and students.

Naylor and Keogh (2013) also emphasise the importance of education ministries recognising the effectiveness of comics in the classroom. They suggest the implementation of professional development programs for teachers to conceptualise the use of cartoons. This could involve the creation of an online package that provides guidance on how to create and effectively utilise comics in teaching.

By implementing these strategies and recommendations, teachers would be better equipped to prepare comics efficiently, enhancing the overall effectiveness of comic instruction in the classroom.

6.7.11 **Finding 11:** Teaching and learning challenges with comics can be addressed when every student has an opportunity to watch cartoon programmes on television at school; remedial teaching in reading is employed; different reading programmes are in place at school; and the language policy is revisited so that there is no transition in the language of instruction between phases.

The findings of this study highlight several proposed strategies to address the challenges associated with teaching and learning through comics. One key strategy is the promotion of comics awareness, which is essential for effective and clear utilization of comics as instructional tools. This

awareness can help comics replace traditional drilling and scaffolding methods. Additionally, efforts should be directed towards improving students' reading skills, enhancing comic literacy, and making comics more appealing to a broader range of students.

Furthermore, the findings emphasise the importance of English as the medium of instruction throughout the schooling years to enhance student learning. This aligns with the conclusions drawn by Trnova et al. (2013) and Mcvicker (2018), who stress the significance of comic awareness as a prerequisite for successful lesson presentation. Comic awareness entails equipping students with visual literacy skills and interdisciplinary competencies, including proficiency in reading English, scientific knowledge, art, and information and communication technology (ICT). Therefore, teachers should ensure that students are adequately prepared to use comics effectively.

Regarding the medium of instruction's impact on learning Science, the findings resonate with the arguments put forth by Henderson and Wellington (1998). They suggest that eliminating language barriers from the Science classroom can lead to increased learning gains. This accentuates the importance of students' proficiency in the language used as the medium of instruction, as it contributes to their better understanding of comics and the subject matter.

6.7.12 Finding 12: Minimal use of comic instruction in Namibian classrooms should be addressed by increased internet coverage, provision of physical resources like printers and computers, and motivating teachers to go the extra mile during teaching and learning.

The findings propose that the government, through the Ministry of Education, should support schools with comic resources, motivate teachers to try new things and train teachers in comic instruction. Muniran and Yusof (2008), in line with the above findings, argue that there should be more seminars, workshops, and meetings with exhibitions to create awareness and to act as a motivation for teachers and the public. These initiatives mean that teachers must be exposed to this type of teaching and learning so that it becomes a popular and trusted method in the process. Muniran and Yusof (2008) also suggest that governments and responsible offices provide the needed direction on what is to be done regarding comics and provide the necessary finances that

would be needed to produce comics. The findings suggest that the government, particularly the Ministry of Education, should take steps to support schools with the necessary comic resources, incentivise teachers to embrace innovative teaching methods, and provide training to educators on the effective use of comic instruction. These initiatives align with the recommendations by Muniran and Yusof (2008), who argue that there should be an increase in the number of seminars, workshops, and exhibitions aimed at raising awareness and motivating teachers and the general public about the benefits of comic-based education.

Furthermore, Muniran and Yusof (2008) recommend that governments and relevant authorities should provide clear guidance on the incorporation of comics into the educational process and allocate the required financial resources for the production and dissemination of educational comics in schools. By ensuring that teachers are motivated, schools are well-equipped, and there is adequate financial support for comics, the successful implementation of comic-based instruction in the educational system can be facilitated and made more effective

CHAPTER 7

Conclusions and recommendations

7.1 Introduction

This chapter provides a comprehensive summary of the study's findings, including a comparison between the data and the existing literature. It presents the conclusions drawn from the study's results and outlines a set of recommendations that will be presented to the Ministry of Education, Arts, and Culture, with the aim of leveraging the potential of comics in Science classrooms in Namibia. Additionally, this chapter offers suggestions for future research directions.

7.2 Summary of the study

The primary objective of this study was to assess the effectiveness of utilising book- and video-mode comics as instructional methods in a resource-constrained ESL primary science classroom. In the context of Namibian primary education, Grade 4 students have needed help comprehending science concepts presented in the English language. The efficacy of diverse forms of comic-based instruction as a means to enhance learning outcomes in the Grade 4 Science classroom, characterised by the transition from one medium of instruction to another, remained unexplored. I conducted a study rooted in Bandura's learning theory to tackle this issue. This study introduced video- and book-mode comics into a primary Science classroom. It examined teachers' viewpoints concerning their experiences and the challenges impacting teaching and learning with comics, as well as potential strategies for addressing these challenges.

7.2.1 Collected data versus the theoretical framework

In this study, Albert Bandura's Social Learning Theory (SLT) served as the underlying theoretical framework. There exists a profound connection between the way comics approach subject matter within the classroom and the principles aligned with Bandura's SLT. This alignment arises from Bandura's perspective that learning is fundamentally a social behaviour that transpires through the process of observing and imitating the actions of others. Bandura notably challenged the

conventional notion that students can exclusively acquire knowledge through direct reinforcement, acknowledging that people can effectively learn by observing a model who serves as a symbolic representation of the subject matter. The empirical data collected in this study corroborate the principles of Bandura's SLT. The comics succeeded in instructing students not through conventional reinforcement and scaffolding but rather through the use of symbolic representations. This is evident, as indicated by the quantitative findings, which demonstrate a statistically significant difference in Grade 4 Science learning outcomes for students exposed to video- and book-mode comic instruction in comparison to those who were taught using traditional methods.

Examining Finding 3 (students pay more attention to comics than to traditional methods of instruction.) in the qualitative section, it becomes apparent that students exhibit greater attentiveness when engaged with comics as opposed to traditional instructional methods. This heightened attention aligns with the observational learning concept espoused by Bandura, where students observe modelled activities to facilitate imitation. The imitation of behaviour becomes evident during experiments or practical activities that students observe. This phenomenon is further underscored by Finding 5 (practical activities with comics are more effective compared to the traditional methods of instruction), which reveals that practical activities prove more effective than traditional methods. This efficacy is made possible by students' ability to imitate behaviours they've observed in the comics. Such imitation is contingent upon students possessing a strong sense of self-efficacy, a central tenet within the framework of SLT.

According to Rumjaun and Narod (2020), students acquire knowledge as they construct a mental representation of the modelled behaviour and subsequently apply it in practical contexts. This knowledge is further reinforced through verbalisation of the observed events. Therefore, in the context of this study, it is assumed that students successfully formed a mental representation of the modelled subject matter. For instance, they were able to mentally visualise the atoms that compose air, even though these atoms were not visible to the naked eye. They observed how air could be confined within the balloon and unable to escape until it was intentionally released. This

understanding enabled them to imitate the actions of the comic characters and visualise the concept of heat energy. Consequently, they endeavoured to capture heat energy in a jar and ascertain if it could be confined inside until it was released. Upon realising that heat does not occupy physical space, this knowledge extended their understanding beyond the realm of matter, leading them to comprehend that heat is a non-material entity.

In addition to bolstering Bandura's SLT, the data presented in this study extend its applicability by cautioning educators about its limitations concerning classroom management.

7.2.2 Collected data versus literature review

The reviewed literature highlights the effectiveness of comic instruction in various classroom settings, focusing on two distinct types of comics: book-mode and video-mode comics. However, the existing literature does not definitively establish whether these two comic modes yield equivalent results or if one is superior. This study aligns with the literature by affirming the efficacy of comics in education while adding new insights by comparing the impacts of video-mode and book-mode comics. It concludes that there is a statistically significant difference in Grade 4 Science learning outcomes between students exposed to video-mode and book-mode comic instruction compared to those taught using traditional methods. Notably, this study found no statistically significant differences in Grade 4 Science learning outcomes between students exposed to video-mode comics and those exposed solely to book-mode comics.

The literature posits that variations in sociocultural environments between urban and rural schools may impact the academic performance of Piaget's concrete operational stage students in Science. While the data substantiate this argument, this study unveils an additional layer of complexity by revealing significant differences in learning achievements between students from a school (with English as the medium of instruction in grades 1 through 3) and a school (with Oshindonga as the medium of instruction in grades 1 through 3), even when both schools are located in the same urban environment. However, it is essential to note that this study does not definitively establish whether the disparity in learning attainment is solely attributed to language policy or if other unexplored factors are at play.

The existing body of literature primarily focuses on comic studies conducted in specific regions of the globe, primarily in Asia, Europe, and the Americas. These regions typically have robust provisions of teaching and learning resources, including access to technological devices that aid teachers in lesson preparation. This body of knowledge emphasises the motivation for the present study, which aims to contribute to a more balanced understanding of educational comic studies. Specifically, it addresses the need for more comic instruction in many African schools. It delves into the reasons behind the reluctance of teachers in under-resourced classrooms to adopt comic instruction. These reasons encompass a need for drawing and acting skills, insufficient funds and resources, and inadequate training and time constraints.

In addition to the documented efficacy and attentiveness associated with comics in the existing literature, the data from the true experimental study and the results of the interviews corroborate the effectiveness of assessment and practical activities when administered during comic instruction, compared to traditional teaching methods. Comic instruction is found to facilitate more effective classroom assessments due to its attractive and accessible activities. Furthermore, practical activities conducted with comics surpass traditional methods in effectiveness, as they enable students to visualise experimental procedures without the need for laboratory equipment, which is often scarce.

The data also reinforce the challenges encountered in teaching and learning, which mirror those described in the literature affecting the adoption of comics in regions such as Asia, Europe, and the Americas. Additionally, the data provide valuable insights into the specific challenges of preparing comics and teaching and learning with comics. Notably, teachers often graduate from universities without any training in comic instruction and may need to be made aware of this teaching method's existence. Creating book-mode or video-mode comics presents challenges as many teachers need more artistic skills for drawing cartoons or the acting skills required for video production. Inadequate funds and lacking essential equipment in some schools further hinder comic production. Moreover, teachers often lack access to experts or individuals with knowledge in producing video-mode comics, limiting their ability to create these materials.

Concerning teaching challenges, the data reveal that teachers generally do not encounter significant obstacles while presenting their lessons with comic instruction. However, they cite time constraints, addressing slow students and students' reading difficulties as challenges. Teachers perceive insufficient time for presenting video comics, and some express concerns about accommodating students with varying learning speeds and reading abilities.

The data also shed light on the potential challenges students may face when learning Science with comics at the Grade 4 level. It is evident that not all students are receptive to cartoons or picture books as learning tools, especially auditory students who prefer auditory-based instruction. Additionally, students who have repeated the junior primary phase twice may struggle with reading and writing skills, potentially benefiting more from video-mode comics with teacher assistance. Moreover, students residing in urban areas may have better comic literacy skills compared to their counterparts from rural villages.

While the reviewed literature did not provide insights into mitigating these challenges, this study offers solutions to enhance students' learning experiences. Teachers participating in the research believe that students can improve their comic interpretation skills, creating a more conducive learning environment, ensuring optimal presentation conditions for video-mode comics, and addressing the reading abilities of students. They also suggest revisiting the language policy, which mandates using local languages as the medium of instruction in government schools.

In conclusion, this study brings to light teachers' perceptions regarding the limited use of comics in Namibian schools and offers potential solutions to address these concerns. It emphasises the need to provide comic materials, finances, and internet access at all schools, as well as comprehensive training in comic instruction at the university level and through workshops for existing teachers. Motivating teachers to explore various teaching methods, including comic instruction, is crucial for enhancing the educational landscape.

7.3 Conclusions

This study has revealed the effectiveness of both video- and book-mode comics in enhancing learning outcomes in Grade 4 Science classrooms. While video-mode comics exhibited a slightly larger increase in learning gains than the book mode, the post-test means did not reach statistical significance ($p=0.17$). Additionally, it was observed that there is a notable difference in Grade 4 Science learning outcomes between students from School S1 (with English as the medium of instruction in grades 1-3) and School S4 (with Oshindonga as the medium of instruction in grades 1-3), despite both schools being located in the same environment. However, it is essential to note that this finding cannot be conclusively attributed to the medium of instruction, as only two schools were examined, and not all potentially influential variables (e.g., admission criteria) were controlled.

Throughout the study, teachers and students identified various challenges encountered during the teaching and learning process. Teachers also provided valuable suggestions for potential strategies to address these challenges. Furthermore, teachers offered recommendations for further research in this area.

7.4 Recommendations

The participating educators recommend that universities offering education programs should provide training and preparation for teachers using comic instruction. It should be compulsory for all teacher trainees to receive exposure to comic instruction during their coursework.

The university administration, in collaboration with the faculties of education, should explore the feasibility of incorporating courses that include elements of comics as a subject in their curriculum. To achieve this, institutions can consider sending their lecturers to international universities renowned for their expertise in comics. This activity can be facilitated through academic staff exchange programs or by establishing international partnerships.

The Ministry of Education must allocate the necessary financial resources, provide support, and ensure the availability of essential resources required to implement comic instruction. These resources may include comic books, cameras, televisions, computers, and internet connectivity. The Ministry should incorporate provisions for these resources within its annual budget, and procurement and distribution can be overseen by the Department of Programmes and Quality Assurance, possibly in collaboration with the National Institutes of Educational Development.

Collaborative programs between educational institutions and the Ministry of Education should be devised to accommodate teachers already in the education system. They may need to catch up on formal training in comic instruction. These programs can enable these teachers to register for in-service training, thus providing them with the opportunity to become familiar with the teaching strategy.

Furthermore, regional education directorates should take the initiative to organise workshops, seminars, and conferences dedicated to the topic of comic instruction. These events can serve as platforms for sensitising teachers and the community to the effectiveness of comics in education. To ensure effective dissemination of this knowledge, senior education officers within the regional directorates of education should undergo training and subsequently share this knowledge with the teachers they oversee. While this initial training may be partial, it can serve as a means to raise awareness and allow teachers to gain first-hand experience with comics. Once teachers know the benefits of comic instruction, they may be more inclined to pursue further training independently, reducing the burden on the government.

Moreover, community members should be educated about the significance of comics in education. This awareness can inspire individuals within the community to explore opportunities within the comic industry, thereby helping to address the shortage of animators and cartoonists in the field.

By implementing these recommendations, educational institutions, government bodies, and communities can work together to promote the effective integration of comics into the education

system, benefiting teachers and students alike. This collaborative approach aims to make learning more engaging and accessible.

7.5 Suggestions for further research

A potential future study could delve deeper into the comparison between video-mode and book-mode comics, explicitly aiming to determine whether the differences between these two modes are statistically significant. The study could expand the number of topics, questions, and experimental methods examined.

Additionally, future research could explore the impact of language on Science instruction by involving a larger sample of schools, differentiating between those with English and local language mediums of instruction. This approach would provide a more comprehensive understanding of how language choice influences Science education, going beyond the limited scope of one school per medium of instruction, as observed in this study.

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Addendums

9.1 Addendum A: Mark Sheets

Table 9.1: *School S1: Pre-test (T1) vs Post-test (T2)*

Group S1A				Group S1B				Group S1C			
CODE	SEX	T1	T2	CODE	SEX	T1	T2	CODE	SEX	T1	T3
S1A1	M	68	70	S1B1	M	53	90	S1C1	M	48	45
S1A2	M	28	33	S1B2	M	78	85	S1C2	M	73	85
S1A3	M	65	63	S1B3	M	45	68	S1C3	M	45	73
S1A4	F	55	63	S1B4	M	35	48	S1C4	F	50	53
S1A5	M	33	60	S1B5	F	43	53	S1C5	M	65	65
S1A6	M	63	70	S1B6	M	53	73	S1C6	M	38	30
S1A7	M	85	98	S1B7	M	70	93	S1C7	M	45	53
S1A8	M	58	58	S1B8	M	83	98	S1C8	F	38	43
S1A9	F	60	78	S1B9	F	53	73	S1C9	F	43	55
S1A10	F	40	65	S1B10	F	30	35	S1C10	M	73	73
S1A11	F	45	65	S1B11	M	70	100	S1C11	M	55	43
S1A12	M	55	78	S1B12	M	35	55	S1C12	M	38	43
S1A13	M	48	75	S1B13	F	45	48	S1C13	F	63	75
S1A14	F	40	58	S1B14	F	58	80	S1C14	F	45	73
S1A15	F	68	88	S1B15	F	38	48	S1C15	M	55	50
AVARAGE		54	68	AVARAGE		53	70	AVERAGE		52	57

Table 9.2: *School S2: Pre-test (T1) vs Post-test (T2)*

Group S2A				Group S2B				Group S2C			
CODE	SEX	T1	T2	CODE	SEX	T1	T2	CODE	SEX	T1	T3
S2A1	M	35	25	S2B1	M	33	48	S2C1	M	50	43
S2A2	F	43	45	S2B2	M	38	65	S2C2	M	48	38
S2A3	F	48	60	S2B3	M	43	58	S2C3	F	40	58
S2A4	M	40	45	S2B4	F	45	55	S2C4	F	55	55
S2A5	M	50	38	S2B5	F	35	60	S2C5	M	30	25
S2A6	M	15	38	S2B6	M	35	50	S2C6	M	38	73
S2A7	F	33	55	S2B7	M	33	38	S2C7	M	30	65
S2A8	F	33	55	S2B8	M	40	45	S2C8	F	43	50
S2A9	M	13	38	S2B9	F	55	53	S2C9	F	45	40
S2A10	M	38	50	S2B10	F	35	53	S2C10	M	50	30
S2A11	F	58	63	S2B11	M	38	40	S2C11	M	33	33
S2A12	M	28	33	S2B12	M	38	35	S2C12	M	40	60
S2A13	F	45	40	S2B13	F	38	70	S2C13	M	40	40
S2A14	F	45	58	S2B14	F	30	53	S2C14	F	30	65
S2A15	F	35	60	S2B15	F	53	73	S2C15	F	45	50
AVARAGE		37	47	AVARAGE		38	53	AVERAGE		41	48

Table 9.3: *School S3: Pre-test (T1) vs Post-test (T2)*

Group S3A				Group S3B				Group S3C			
CODE	SEX	T1	T2	CODE	SEX	T1	T2	CODE	SEX	T1	T3
S3A1	M	33	33	S3B1	M	40	50	S3C1	M	45	33
S3A2	M	-	-	S3B2	M	30	43	S3C2	M	58	60
S3A3	M	65	78	S3B3	M	28	50	S3C3	M	53	48
S3A4	M	25	40	S3B4	M	75	73	S3C4	M	35	40
S3A5	F	25	35	S3B5	F	52	55	S3C5	F	58	68
S3A6	F	45	63	S3B6	F	40	50	S3C6	F	53	40
S3A7	F	48	65	S3B7	F	55	60	S3C7	F	35	38
S3A8	F	40	60	S3B8	F	35	38	S3C8	F	28	33
S3A9	M	40	48	S3B9	M	38	53	S3C9	M	-	-
S3A10	M	38	38	S3B10	M	30	38	S3C10	M	40	40
S3A11	M	38	53	S3B11	M	33	48	S3C11	M	38	45
S3A12	F	63	73	S3B12	M	48	50	S3C12	M	48	40
S3A13	M	45	53	S3B13	F	35	43	S3C13	F	38	40
S3A14	F	30	38	S3B14	F	60	63	S3C14	F	45	53
S3A15	F	40	58	S3B15	F	50	65	S3C15	F	48	53
AVARAGE		41	53	AVARAGE		43	52	AVERAGE		44	45

Table 9.4: *School S4: Pre-test (T1) vs Post-test (T2)*

Group S4A				Group S4B				Group S4C			
CODE	SEX	T1	T2	CODE	SEX	T1	T2	CODE	SEX	T1	T2
S4A1	M	35	35	S4B1	M	28	38	S4C1	M	38	65
S4A2	M	43	48	S4B2	M	30	50	S4C2	M	38	35
S4A3	M	30	35	S4B3	M	25	48	S4C3	F	55	60
S4A4	F	68	73	S4B4	F	25	53	S4C4	F	28	50
S4A5	F	43	68	S4B5	F	45	70	S4C5	F	43	35
S4A6	M	25	40	S4B6	M	20	43	S4C6	M	23	28
S4A7	M	45	58	S4B7	M	38	40	S4C7	M	73	65
S4A8	M	28	35	S4B8	F	30	53	S4C8	F	35	28
S4A9	F	50	70	S4B9	F	28	58	S4C9	F	38	40
S4A10	F	33	43	S4B10	F	53	55	S4C10	F	42	40
S4A11	M	15	35	S4B11	M	28	70	S4C11	M	35	43
S4A12	M	35	50	S4B12	M	40	65	S4C12	M	33	53
S4A13	M	38	38	S4B13	F	45	60	S4C13	F	35	40
S4A14	F	35	50	S4B14	F	35	73	S4C14	F	20	38
S4A15	F	38	48	S4B15	F	40	33	S4C15	F	38	53
AVARAGE		37	48	AVARAGE		34	54	AVERAGE		38	45

9.2 Addendum B: Test Performance per section for S1, S2, S3 and S4

Table 9.5: *Section A vs Section B for School S1*

Group S1A						Group S2B						Group S2C					
Code	Sex	T1	T1	T2	T2	Code	Sex	T1	T1	T2	T2	Code	Sex	T1	T1	T2	T2
		A	B	A	B			A	B	A	B			A	B	A	B
S1A1	M	13	14	14	14	S1B1	M	10	11	18	18	S1C1	M	8	11	8	10
S1A2	M	7	4	6	7	S1B2	M	16	15	18	16	S1C2	M	14	15	18	16
S1A3	M	14	12	14	11	S1B3	M	9	9	14	13	S1C3	M	10	8	15	14
S1A4	F	11	11	12	13	S1B4	M	5	9	10	9	S1C4	F	9	11	11	10
S1A5	M	6	7	12	12	S1B5	F	10	7	9	12	S1C5	M	14	12	12	14
S1A6	M	12	13	14	14	S1B6	M	9	12	14	15	S1C6	M	8	7	5	7
S1A7	M	17	18	19	20	S1B7	M	12	16	19	18	S1C7	M	10	8	11	10
S1A8	M	12	11	10	13	S1B8	M	16	17	19	20	S1C8	F	8	7	9	8
S1A9	F	13	12	16	15	S1B9	F	12	9	16	13	S1C9	F	9	8	12	10
S1A10	F	8	8	14	12	S1B10	F	7	5	7	7	S1C10	M	15	14	15	14
S1A11	F	10	8	13	13	S1B11	M	13	15	20	20	S1C11	M	11	11	10	7
S1A12	M	10	12	17	14	S1B12	M	9	5	11	11	S1C12	M	7	8	9	8
S1A13	M	11	11	15	15	S1B13	F	11	7	10	9	S1C13	F	12	13	14	16
S1A14	F	8	8	11	12	S1B14	F	11	12	18	14	S1C14	F	9	9	14	15
S1A15	F	14	16	17	18	S1B15	F	9	6	10	9	S1C15	M	12	10	10	10
Average		11	11	14	14	Average		11	10	14	14	Average		10	10	12	11

Section A for S1/T1 = 11+11+10 = 32/3 = 10.67

Section B for S1/T1 = 11 + 10 +10 = 31/3 = 10.33

Section A for S1/T2 = 14+14+12 = 40/3 = 13.33

Section B for S1/T2 = 14+14+11 = 39/3 = 13.00

Table 9.6: *Section A vs Section B for School S2*

Group S2A						Group S2B						Group S2C					
Code	Sex	T1	T1	T2	T2	Code	Sex	T1	T1	T2	T2	Code	Sex	T1	T1	T2	T2
		A	B	A	B			A	B	A	B			A	B	A	B
S2A1	M	5	9	5	5	S2B1	M	7	6	10	9	S2C1	M	10	10	8	9
S2A2	F	8	9	10	8	S2B2	M	8	7	14	12	S2C2	M	9	10	7	8
S2A3	F	9	10	12	12	S2B3	M	10	7	13	11	S2C3	F	8	8	12	11
S2A4	M	8	8	10	8	S2B4	F	8	10	11	10	S2C4	F	13	9	11	11
S2A5	M	8	12	7	8	S2B5	F	8	6	12	12	S2C5	M	6	6	4	6
S2A6	M	4	2	8	7	S2B6	M	7	7	10	10	S2C6	M	6	9	15	14
S2A7	F	5	8	13	9	S2B7	M	9	4	7	8	S2C7	M	4	8	14	12
S2A8	F	5	8	12	10	S2B8	M	7	9	8	10	S2C8	F	10	7	11	9
S2A9	M	2	3	7	8	S2B9	F	10	12	10	11	S2C9	F	10	8	6	10
S2A10	M	7	8	11	9	S2B10	F	9	5	10	11	S2C10	M	9	11	7	5
S2A11	F	11	12	14	11	S2B11	M	7	8	8	8	S2C11	M	5	8	7	6
S2A12	M	6	5	6	7	S2B12	M	7	8	6	8	S2C12	M	7	9	13	11
S2A13	F	11	7	8	8	S2B13	F	3	3	13	15	S2C13	M	6	10	8	8
S2A14	F	8	10	13	10	S2B14	F	5	7	10	11	S2C14	F	5	7	14	12
S2A15	F	7	7	14	10	S2B15	F	9	12	14	15	S2C15	F	7	11	9	11
Average		7	8	10	9	Average		8	7	10	11	Average		8	9	10	10

Table 9.7: *Section A vs Section B for School S3*

Group S3A						Group S3B						Group S3C					
Code	Sex	T1	T1	T2	T2	Code	Sex	T1	T1	T2	T2	Code	Sex	T1	T1	T2	T2
		A	B	A	B			A	B	A	B			A	B	A	B
S3A1	M	7	6	6	7	S3B1	M	9	7	9	11	S3C1	M	10	8	5	8
S3A2	F	9	7	-	-	S3B2	M	6	6	8	9	S3C2	M	12	11	13	11
S3A3	F	13	13	16	15	S3B3	M	4	7	10	10	S3C3	M	11	10	10	9
S3A4	M	4	6	8	8	S3B4	M	16	14	14	15	S3C4	M	8	6	8	8
S3A5	M	5	5	7	7	S3B5	F	12	9	10	12	S3C5	F	10	13	13	14
S3A6	M	9	9	12	13	S3B6	F	8	8	9	11	S3C6	F	10	11	8	8
S3A7	F	9	10	13	13	S3B7	F	13	9	12	12	S3C7	F	5	6	7	8
S3A8	F	8	8	10	14	S3B8	F	8	6	8	7	S3C8	F	7	4	5	8
S3A9	M	8	8	9	10	S3B9	M	7	8	11	10	S3C9	M	12	12	-	-
S3A10	M	7	8	7	8	S3B10	M	5	7	8	7	S3C10	M	6	10	8	8
S3A11	F	8	7	10	11	S3B11	M	8	5	10	9	S3C11	M	6	9	8	10
S3A12	M	11	14	14	15	S3B12	M	9	10	10	10	S3C12	M	9	10	6	10
S3A13	F	8	10	8	13	S3B13	F	8	6	8	9	S3C13	F	7	8	8	8
S3A14	F	6	6	6	9	S3B14	F	13	11	13	12	S3C14	F	10	8	10	11
S3A15	F	8	8	11	12	S3B15	F	10	10	14	12	S3C15	F	8	11	12	9
Average		8	8	10	11	Average		9	8	10	10	Average		9	9	9	9

Table 9.8: *Section A vs Section B for School S4*

Group S4A						Group S4B						Group S4C					
Code	Sex	T1	T1	T2	T2	Code	Sex	T1	T1	T2	T2	Code	Sex	T1	T1	T2	T2
		A	B	A	B			A	B	A	B			A	B	A	B
S4A1	M	6	7	8	6	S4B1	M	4	7	7	8	S4C1	M	8	7	13	13
S4A2	M	9	8	10	9	S4B2	M	6	6	10	10	S4C2	M	8	6	7	7
S4A3	M	6	6	6	8	S4B3	M	6	4	11	8	S4C3	F	11	11	11	13
S4A4	F	12	15	14	15	S4B4	F	5	5	12	9	S4C4	F	7	4	8	12
S4A5	F	7	10	13	14	S4B5	F	9	9	14	14	S4C5	F	7	10	6	8
S4A6	M	5	5	7	9	S4B6	M	5	3	8	9	S4C6	M	4	5	5	6
S4A7	M	8	10	10	13	S4B7	M	7	8	9	7	S4C7	M	14	15	14	12
S4A8	M	4	11	7	7	S4B8	F	7	5	10	11	S4C8	F	7	7	4	7
S4A9	F	11	9	14	14	S4B9	F	5	6	11	12	S4C9	F	9	6	8	8
S4A10	F	7	6	9	8	S4B10	F	9	12	11	11	S4C10	F	7	10	9	7
S4A11	M	2	4	6	8	S4B11	M	4	7	14	14	S4C11	M	6	8	8	9
S4A12	M	8	6	10	10	S4B12	M	9	7	12	14	S4C12	M	5	8	10	11
S4A13	M	6	9	7	8	S4B13	F	10	8	11	13	S4C13	F	8	6	8	8
S4A14	F	6	8	11	9	S4B14	F	7	7	15	14	S4C14	F	4	4	8	7
S4A15	F	6	9	9	10	S4B15	F	9	7	5	8	S4C15	F	8	7	10	11
Average		7	8	9	10	Average		7	7	11	11	Average		8	8	9	9

9.3 Addendum C: School*Group*Time LSD Post-hoc table and Hedge G Table

Table 9.9: *School*Group*Time LSD Post-hoc table*

	School	group	time	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}	{9}	{10}	{11}	{12}	{13}	{14}	{15}	{16}	{17}	{18}	{19}	{20}	{21}	{22}	{23}	{24}
				51.6	57.2667	54.0667	68.1333	52.6	69.8	41.1333	48.3333	37.2667	46.8667	39.2667	53.0667	44.4229	45.0711	41.0711	52.5	43.2667	51.9333	38.2667	44.8667	37.4	48.4	34	53.9333
1	s1	Control	pre		0.05	0.6	<0.01	0.83	<0.01	0.03	0.49	<0.01	0.31	<0.01	0.75	0.13	0.71	0.03	0.85	0.08	0.94	<0.01	0.15	<0.01	0.5	<0.01	0.62
2	s1	Control	post	0.05		0.5	0.02	0.32	<0.01	<0.01	0.06	<0.01	0.03	<0.01	0.37	<0.01	0.01	<0.01	0.32	<0.01	0.26	<0.01	<0.01	<0.01	0.06	<0.01	0.48
3	s1	Book mode comics	pre	0.6	0.5		<0.01	0.75	<0.01	<0.01	0.22	<0.01	0.13	<0.01	0.83	0.04	0.06	<0.01	0.74	0.02	0.65	<0.01	0.05	<0.01	0.23	<0.01	0.98
4	s1	Book mode comics	post	<0.01	0.02	<0.01		<0.01	0.72	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
5	s1	Video Mode Comics	pre	0.83	0.32	0.75	<0.01		<0.01	0.02	0.36	<0.01	0.22	<0.01	0.92	0.09	0.12	0.02	0.98	0.05	0.89	<0.01	0.1	<0.01	0.37	<0.01	0.78
6	s1	Video Mode Comics	post	<0.01	<0.01	<0.01	0.72	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
7	s2	Control	pre	0.03	<0.01	<0.01	<0.01	0.02	<0.01		0.01	0.41	0.22	0.69	0.01	0.49	0.41	0.99	0.02	0.65	0.02	0.54	0.43	0.43	0.12	0.13	<0.01
8	s2	Control	post	0.49	0.06	0.22	<0.01	0.36	<0.01	0.01		0.02	0.75	0.05	0.31	0.41	0.5	0.13	0.38	0.28	0.44	0.03	0.46	0.02	0.99	<0.01	0.23
9	s2	Book mode comics	pre	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.41	0.02		<0.01	0.67	<0.01	0.14	0.1	0.43	<0.01	0.2	<0.01	0.83	0.11	0.98	0.02	0.49	<0.01
10	s2	Book mode comics	post	0.31	0.03	0.13	<0.01	0.22	<0.01	0.22	0.75	<0.01		0.11	0.19	0.61	0.71	0.23	0.24	0.44	0.28	0.07	0.67	0.04	0.74	<0.01	0.13
11	s2	Video Mode Comics	pre	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.69	0.05	0.67	0.11		<0.01	0.28	0.23	0.71	<0.01	0.39	<0.01	0.83	0.23	0.69	0.05	0.26	<0.01

1	s2	Video	p	0.	0.3	0.8	<0.	0.	<0	0.0	0.3	<0.	0.1	<0.		0.0	0.1	0.0	0.	0.0	0.8	<0.	0.0	<0	0.	<0	0.8
2		Mode	os	75	7	3	01	92	.0	1	1	01	9	01		7		1	91	4	1	01	8	.0	32	.0	5
		Comics	t						1															1		1	
1	s3	Control	pr	0.	<0.	0.0	<0.	0.	<0	0.4	0.4	0.1	0.6	0.2	0.0		0.8	0.4	0.	0.8	0.1	0.2	0.9	0.	0.	0.	0.0
3			e	13	01	4	01	09	.0	9	1	4	1	8	7		3	9	1	1	2		3	14	41	03	5
									1																		
1	s3	Control	p	0.	0.0	0.0	<0.	0.	<0	0.4	0.5	0.1	0.7	0.2	0.1	0.8		0.4	0.	0.7	0.1	0.1	0.9	0.	0.	0.	0.0
4			os	17	1	6	01	12	.0	1			1	3		3		1	13	1	5	6	7	11	49	02	6
			t						1																		
1	s3	Book	pr	0.	<0.	<0.	<0.	0.	<0	0.9	0.1	0.4	0.2	0.7	0.0	0.4	0.4		<0	0.6	0.0	0.5	0.4	0.	0.	0.	<0.
5		mode	e	03	01	01	01	02	.0	9	3	3	3	1	1	9	1		.0	5	2	6	3	44	13	14	01
		comics							1										1								
1	s3	Book	p	0.	0.3	0.7	<0.	0.	<0	0.0	0.3	<0.	0.2	<0.	0.9	0.1	0.1	<0.		0.0	0.9	<0.	0.1	<0	0.	<0	0.7
6		mode	os	85	2	4	01	98	.0	2	8	01	4	01	1		3	01		5	1	01	1	.0	39	.0	6
		comics	t						1															1		1	
1	s3	Video	pr	0.	<0.	0.0	<0.	0.	<0	0.6	0.2	0.2	0.4	0.3	0.0	0.8	0.7	0.6	0.		<0.	0.2	0.7	0.	0.	0.	0.0
7		Mode	e	08	01	2	01	05	.0	5	8		4	9	4	1	1	5	05		01	9	3	21	28	05	2
		Comics							1																		
1	s3	Video	p	0.	0.2	0.6	<0.	0.	<0	0.0	0.4	<0.	0.2	<0.	0.8	0.1	0.1	0.0	0.	<0.		<0.	0.1	<0	0.	<0	0.6
8		Mode	os	94	6	5	01	89	.0	2	4	01	8	01	1	2	5	2	91	01		01	3	.0	45	.0	7
		Comics	t						1															1		1	
1	s4	Control	pr	<0	<0.	<0.	<0.	<0	<0	0.5	0.0	0.8	0.0	0.8	<0.	0.2	0.1	0.5	<0	0.2	<0.		0.0	0.	0.	0.	<0.
9			e	.0	01	01	01	.0	.0	4	3	3	7	3	01		6	6	.0	9	01		2	85	03	36	01
				1				1	1										1								
2	s4	Control	p	0.	<0.	0.0	<0.	0.	<0	0.4	0.4	0.1	0.6	0.2	0.0	0.9	0.9	0.4	0.	0.7	0.1	0.0		0.	0.	0.	0.0
0			os	15	01	5	01	1	.0	3	6	1	7	3	8	3	7	3	11	3	3	2		11	45	02	5
			t						1																		
2	s4	Book	pr	<0	<0.	<0.	<0.	<0	<0	0.4	0.0	0.9	0.0	0.6	<0.	0.1	0.1	0.4	<0	0.2	<0.	0.8	0.1		<0	0.	<0.
1		mode	e	.0	01	01	01	.0	.0	3	2	8	4	9	01	4	1	4	.0	1	01	5	1		.0	47	01
		comics		1				1	1										1						1		
2	s4	Book	p	0.	0.0	0.2	<0.	0.	<0	0.1	0.9	0.0	0.7	0.0	0.3	0.4	0.4	0.1	0.	0.2	0.4	0.0	0.4	<0		<0	0.2
2		mode	os	5	6	3	01	37	.0	2	9	2	4	5	2	1	9	3	39	8	5	3	5	.0		.0	4
		comics	t						1															1		1	
2	s4	Video	pr	<0	<0.	<0.	<0.	<0	<0	0.1	<0.	0.4	<0.	0.2	<0.	0.0	0.0	0.1	<0	0.0	<0.	0.3	0.0	0.	<0		<0.
3		Mode	e	.0	01	01	01	.0	.0	3	01	9	01	6	01	3	2	4	.0	5	01	6	2	47	.0		01
		Comics		1				1	1										1						1		
2	s4	Video	p	0.	0.4	0.9	<0.	0.	<0	<0.	0.2	<0.	0.1	<0.	0.8	0.0	0.0	<0.	0.	0.0	0.6	<0.	0.0	<0	0.	<0	
4		Mode	os	62	8	8	01	78	.0	01	3	01	3	01	5	5	6	01	76	2	7	01	5	.0	24	.0	
		Comics	t						1															1		1	

Table 9.10: *Hedge's G: School*Group Properties*

	school	group	time	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}	{9}	{10}	{11}	{12}	{13}	{14}	{15}	{16}	{17}	{18}	{19}	{20}	{21}	{22}	{23}	{24}
1	s1	BM	p		0.9	0.6	1.1	0.0	0.9	1.5	2.2	1.3	2.2	1.1	2.4	1.0	1.9	1.7	1.8	1.2	1.7	1.3	2.2	1.6	2.1	1.0	2.6
		com	o		1(L	9(	9(V	9(N	6(L	6(	(M)	2(V	(M)	1(V	(M)	3(L	4(	4(	5(	4(V	2(	6(V	(M)	6(	(M)	1(L	8(
		ics	st		)	M)	L)	)	)	M)		L)		L)		)	M)	M)	M)	L)	M)	L)		M)		)	M)
2	s1	BM	p	0.9		0.2	0.1	0.8	0.0	0.5	1.1	0.3	1.0	0.0	1.2	0.1	0.9	0.6	0.7	0.1	0.7	0.3	1.1	0.6	1.1	0.0	1.5
		com	re	1(L		(S)	8(S	4(L	9(N	2(	9(V	8(S	4(L	7(N	1(V	(N)	2(L	7(	4(	6(S	4(	9(S	8(V	5(	(VL	1(N	5(
		ics		)			)	)	)	M)	L)	)	)	)	L)		)	M)	M)	)	M)	)	L)	M)	)	)	M)
3	s1	Cont	p	0.6	0.2		0.3	0.6	0.2	0.7	1.3	0.5	1.2	0.3	1.4	0.3	1.1	0.8	0.9	0.3	0.9	0.5	1.3	0.8	1.2	0.2	1.7
		rol	o	9(	(S)		9(S	6(	8(S	3(	8(V	8(	6(V	(S)	3(V	1(S	2(V	9(L	6(L	9(S	4(L	9(	7(V	6(L	9(V	3(S	5(
			st	M)			)	M)	)	M)	L)	M)	L)		L)	)	L)	)	)	)	)	M)	L)	)	L)	)	M)
4	s1	Cont	p	1.1	0.1	0.3		1.0	0.0	0.3	1.1	0.2	1.(L	0.1	1.2	0.0	0.8	0.5	0.6	0.0	0.6	0.2	1.1	0.5	1.0	0.1	1.6
		rol	re	9(V	8(S	9(S		4(L	7(N	9(S	5(V	4(S	)	2(N	1(V	7(N	5(L	7(	5(	3(N	4(	5(S	5(V	4(	5(L	9(S	(M)
				L)	)	)		)	)	)	L)	)		)	L)	)	)	M)	M)	)	M)	)	L)	M)	)	)	
5	s1	VM	p	0.0	0.8	0.6	1.0		0.8	1.3	1.8	1.1	1.7	0.9	1.9	0.9	1.6	1.4	1.5	1.0	1.4	1.1	1.8	1.4	1.7	0.9	2.1
		com	o	9(N	4(L	6(	4(L		9(L	2(V	5(	7(V	6(	7(L	(M)	3(L	2(	4(V	1.5	1.0	1(	9(V	4(	1(V	7(	(L)	5(
		ics	st	)	)	M)	)		)	L)	M)	L)	M)	)		)	M)	L)	M)	6(L	M)	L)	M)	L)	M)		M)
6	s1	VM	p	0.9	0.0	0.2	0.0	0.8		0.3	1.0	0.2	0.8	0.0	1.0	0.0	0.7	0.5	0.5	0.0	0.6	0.2	1.0	0.5	0.9	0.0	1.3
		com	re	6(L	9(N	8(S	7(N	9(L		9(S	3(L	7(S	7(L	3(N	3(L	1(N	8(L	3(	9(	5(N	1(	7(S	3(L	2(	5(L	9(N	6(V
		ics		)	)	)	)	)		)	)	)	)	)	)	)	)	M)	M)	)	M)	)	)	M)	)	)	L)
7	s2	BM	p	1.5	0.5	0.7	0.3	1.3	0.3		0.7	0.1	0.5	0.5	0.7	0.4	0.4	0.1	0.2	0.4	0.2	0.1	0.7	0.1	0.6	0.5	1.2
		com	o	6(	2(	3(	9(S	2(V	9(S		9(L	1(N	7(	4(	8(L	2(	8(	6(S	3(S	6(	8(S	2(N	8(L	6(S	9(	8(	1(V
		ics	st	M)	M)	M)	)	L)	)		)	)	M)	M)	)	M)	M)	)	)	M)	)	)	)	)	M)	M)	L)
8	s2	BM	p	2.2	1.1	1.3	1.1	1.8	1.0	0.7		0.8	0.3	1.3	0.1	1.1	0.3	0.6	0.6	1.2	0.4	0.8	0.0	0.6	0.0	1.3	0.2
		com	re	(M)	9(V	8(V	5(V	5(	3(L	9(L		1(L	0.3	2(V	9(S	1(V	1(S	7(	4(	8(V	6(	5(L	1(N	1(	8(N	2(V	9(S
		ics			L)	L)	L)	M)	)	)		)	7(S	L)	)	L)	)	M)	M)	L)	M)	)	)	M)	)	L)	)
9	s2	Cont	p	1.3	0.3	0.5	0.2	1.1	0.2	0.1	0.8		0.6	0.3	0.7	0.2	0.5	0.2	0.3	0.2	0.3	0.(	0.8	0.2	0.7	0.4	1.1
		rol	o	2(V	8(S	8(	4(S	7(V	7(S	1(N	1(L		1(	6(S	8(L	8(S	4(	5(S	1(S	9(S	6(S	N)	1(L	5(S	3(	1(	6(V
			st	L)	)	M)	)	L)	)	)	)		M)	)	)	)	M)	)	)	)	)		)	)	M)	M)	L)
1	s2	Cont	p	2.2	1.0	1.2	1.(L	1.7	0.8	0.5	0.3	0.6		1.2	0.2	0.9	0.0	0.4	0.3	1.1	0.1	0.6	0.3	0.3	0.2	1.2	0.8
0		rol	re	(M)	4(L	6(V	)	6(	7(L	7(	7(S	1(		(VL	4(S	6(L	1(N	2(	7(S	7(V	9(S	5(	5(S	5(S	6(S	(VL	1(L
					)	L)		M)	)	M)	)	M)		)	)	)	)	M)	)	L)	)	M)	)	)	)	)	)
1	s2	VM	p	1.1	0.0	0.3	0.1	0.9	0.0	0.5	1.3	0.3	1.2		1.4	0.0	1.0	0.7	0.8	0.1	0.7	0.3	1.3	0.6	1.2	0.0	1.8
1		com	o	1(V	7(N	(S)	2(N	7(L	3(N	4(	2(V	6(S	(VL		4(V	4(N	1(L	3(	2(L	(N)	8(L	7(S	1(V	8(	1(V	7(N	2(
		ics	st	L)	)		)	)	)	M)	L)	)	)		L)	)	)	M)	)		)	)	L)	M)	L)	)	M)
1	s2	VM	p	2.4	1.2	1.4	1.2	1.9	1.0	0.7	0.1	0.7	0.2	1.4		1.1	0.1	0.6	0.6	1.4	0.3	0.8	0.1	0.5	0.0	1.4	0.6
2		com	re	(M)	1(V	3(V	1(V	(M)	3(L	8(L	9(S	8(L	4(S	4(V		4(V	8(S	5(	1(	2(V	7(S	3(L	8(S	5(	9(N	2(V	2(
		ics			L)	L)	L)		)	)	)	)	)	L)		L)	)	M)	M)	L)	)	)	)	M)	)	L)	M)
1	s3	BM	p	1.0	0.1	0.3	0.0	0.9	0.0	0.4	1.1	0.2	0.9	0.0	1.1		0.8	0.5	0.6	0.0	0.6	0.2	1.1	0.5	1.0	0.1	1.5
3		com	o	3(L	(N)	1(S	7(N	3(L	1(N	2(	1(V	8(S	6(L	4(N	4(V		4(L	8(	5(	4(N	5(	9(S	1(V	6(	2(L	(N)	(M)
		ics	st	)		)	)	)	)	M)	L)	)	)	)	L)		)	M)	M)	)	M)	)	L)	M)	)		
1	s3	BM	p	1.9	0.9	1.1	0.8	1.6	0.7	0.4	0.3	0.5	0.0	1.0	0.1	0.8		0.3	0.3	0.9	0.1	0.5	0.3	0.3	0.2	1.0	0.6
4		com	re	4(	2(L	2(V	5(L	2(	8(L	8(	1(S	4(	1(N	1(L	8(S	4(L		5(S	1(S	6(L	7(S	6(	(S)	1(S	2(S	3(L	5(
		ics		M)	)	L)	)	M)	)	M)	)	M)	)	)	)	)		)	)	)	)	M)		)	)	)	M)
1	s3	Cont	p	1.7	0.6	0.8	0.5	1.4	0.5	0.1	0.6	0.2	0.4	0.7	0.6	0.5	0.3		0.0	0.6	0.1	0.2	0.6	0.0	0.5	0.7	1.1
5		rol	o	4(	7(	9(L	7(	4(V	3(	6(S	7(	5(S	2(	3(	5(	8(	5(S		6(	6(	5(S	7(S	6(	2(N	7(	6(L	1(V
			st	M)	M)	)	M)	L)	M)	)	M)	)	M)	M)	M)	M)	)		N)	M)	)	)	M)	)	M)	)	L)

1	s3	Cont	p	1.8	0.7	0.9	0.6	1.5	0.5	0.2	0.6	0.3	0.3	0.8	0.6	0.6	0.3	0.0		0.7	0.1	0.3	0.6	0.0	0.5	0.8	1.1
6		rol	re	5(	4(	6(L	5(	1(	9(	3(S	4(	1(S	7(S	2(L	1(	5(	1(S	6(N		6(L	(N)	4(S	3(	4(N	4(	5(L	(VL
				M)	M)	)	M)	M)	M)	)	M)	)	)	)	M)	M)	)	)		)		)	M)	)	M)	)	)
1	s3	VM	p	1.2	0.1	0.3	0.0	1.0	0.0	0.4	1.2	0.2	1.1	0.1	1.4	0.0	0.9	0.6	0.7		0.7	0.2	1.2	0.6	1.1	0.1	1.8
7		com	o	4(V	6(S	9(S	3(N	6(L	5(N	6(	8(V	9(S	7(V	(N)	2(V	4(N	6(L	6(	6(L		2(	9(S	8(V	2(	7(V	7(S	2(
		ics	st	L)	)	)	)	)	)	M)	L)	)	L)		L)	)	)	M)	)		M)	)	L)	M)	L)	)	M)
1	s3	VM	p	1.7	0.7	0.9	0.6	1.4	0.6	0.2	0.4	0.3	0.1	0.7	0.3	0.6	0.1	0.1	0.1	0.7		0.3	0.4	0.1	0.3	0.8	0.7
8		com	re	2(	4(	4(L	4(	7(	1(	8(S	6(	6(S	9(S	8(L	7(S	5(	7(S	5(S	(N)	2(		8(S	5(	2(N	8(S	1(L	9(L
		ics		M)	M)	)	M)	M)	M)	)	M)	)	)	)	)	M)	)	)		M)		)	M)	)	)	)	)
1	s4	BM	p	1.3	0.3	0.5	0.2	1.1	0.2	0.1	0.8	0.(	0.6	0.3	0.8	0.2	0.5	0.2	0.3	0.2	0.3		0.8	0.2	0.7	0.4	1.2
9		com	o	6(V	9(S	9(	5(S	9(V	7(S	2(N	5(L | N)	5(	7(S	3(L	9(S	6(	7(S	4(S	9(S	8(S		4(L	7(S	6(L	2(	2(V
		ics	st	L)	)	M)	)	L)	)	)	)		M)	)	)	)	M)	)	)	)	)		)	)	)	M)	L)
2	s4	BM	p	2.2	1.1	1.3	1.1	1.8	1.0	0.7	0.0	0.8	0.3	1.3	0.1	1.1	0.3	0.6	0.6	1.2	0.4	0.8		0.6	0.0	1.3	0.3
0		com	re	(M)	8(V	7(V	5(V	4(	3(L	8(L	1(N	1(L	5(S	1(V	8(S	1(V	(S)	6(	3(	8(V	5(	4(L		(M)	7(N	2(V	1(S
		ics			L)	L)	L)	M)	)	)	)	)	)	L)	)	L)		M)	M)	L)	M)	)			)	L)	)
2	s4	Cont	p	1.6	0.6	0.8	0.5	1.4	0.5	0.1	0.6	0.2	0.3	0.6	0.5	0.5	0.3	0.0	0.0	0.6	0.1	0.2	0.6		0.5	0.7	0.9
1		rol	o	6(	5(	6(L	4(	1(V	2(	6(S	1(	5(S	5(S	8(	5(	6(	1(S	2(N	4(	2(	2(	7(S	(M)		2(	2(	8(L
			st	M)	M)	)	M)	L)	M)	)	M)	)	)	M)	M)	M)	)	)	N)	M)	N)	)			M)	M)	)
2	s4	Cont	p	2.1	1.1	1.2	1.0	1.7	0.9	0.6	0.0	0.7	0.2	1.2	0.0	1.0	0.2	0.5	0.5	1.1	0.3	0.7	0.0	0.5		1.2	0.3
2		rol	re	(M)	(VL	9(V	5(L	7(	5(L	9(	8(N	3(	6(S	1(V	9(N	2(L	2(S	7(	4(	7(V	8(S	6(L	7(N	2(		2(V	7(S
					)	L)	)	M)	)	M)	)	M)	)	L)	)	)	)	M)	M)	L)	)	)	)	M)		L)	)
2	s4	VM	p	1.0	0.0	0.2	0.1	0.9	0.0	0.5	1.3	0.4	1.2	0.0	1.4	0.1	1.0	0.7	0.8	0.1	0.8	0.4	1.3	0.7	1.2		1.7
3		com	o	1(L	1(N	3(S	9(S	(L)	9(N	8(	2(V	1(	(VL	7(N	2(V	(N)	3(L	6(L	5(L	7(S	1(L	2(	2(V	2(	2(V		9(
		ics	st	)	)	)	)		)	M)	L)	M)	)	)	L)		)	)	)	)	)	M)	L)	M)	L)		M)
2	s4	VM	p	2.6	1.5	1.7	1.6	2.1	1.3	1.2	0.2	1.1	0.8	1.8	0.6	1.5	0.6	1.1	1.1	1.8	0.7	1.2	0.3	0.9	0.3	1.7	
4		com	re	8(	5(	5(	(M)	5(	6(V	1(V	9(S	6(V	1(L	2(	2(	(M)	5(	1(V	(VL	2(	9(L	2(V	1(S	8(L	7(S	9(	
		ics		M)	M)	M)		M)	L)	L)	)	L)	)	M)	M)		M)	L)	)	M)	)	L)	)	)	)	M)	

9.4 Addendum D: Descriptive Statistics

***Table 9.11**: Descriptive Statistics*

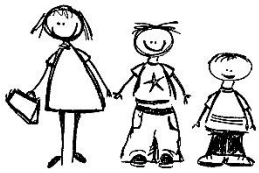
	Level of Factor	Level of Factor	Level of Factor	N	x Mean	x Std.Dev.
Total				356	48.132	15.285
school	s1			90	58.9111	17.2911
school	s2			90	44.3222	12.0092
school	s3			86	46.407	12.1029
school	s4			90	42.8111	13.6059
group	Book mode comics			118	48.2373	16.1137
group	Control			118	46.3983	12.9965
group	Video Mode Comics			120	49.7333	16.4326
time	post			178	53.3989	15.4588
time	pre			178	42.8652	13.1838
school*group	s1	Book mode comics		30	61.1	16.4345
school*group	s1	Control		30	54.4333	14.0803
school*group	s1	Video Mode Comics		30	61.2	20.4474
school*group	s2	Book mode comics		30	42.0667	12.6052
school*group	s2	Control		30	44.7333	11.8959
school*group	s2	Video Mode Comics		30	46.1667	11.5433
school*group	s3	Book mode comics		28	46.7857	14.2474
school*group	s3	Control		28	44.75	9.5204
school*group	s3	Video Mode Comics		30	47.6	12.3165
school*group	s4	Book mode comics		30	42.9	13.6946
school*group	s4	Control		30	41.5667	12.6836
school*group	s4	Video Mode Comics		30	43.9667	14.7215
school*time	s1	post		45	65.0667	17.9259
school*time	s1	pre		45	52.7556	14.3498
school*time	s2	post		45	49.4222	12.3463
school*time	s2	pre		45	39.2222	9.2782
school*time	s3	post		43	49.8837	11.8868
school*time	s3	pre		43	42.9302	11.4193
school*time	s4	post		45	49.0667	12.8848
school*time	s4	pre		45	36.5556	11.3309
group*time	Book mode comics	post		59	54	15.7535
group*time	Book mode comics	pre		59	42.4746	14.4238
group*time	Control	post		59	48.9492	13.9326

group*time	Control	pre		59	43.8475	11.5487
group*time	Video Mode Comics	post		60	57.1833	15.7292
group*time	Video Mode Comics	pre		60	42.2833	13.5773
school*group*time	s1	Book mode comics	post	15	68.1333	14.9134
school*group*time	s1	Book mode comics	pre	15	54.0667	15.2009
school*group*time	s1	Control	post	15	57.2667	15.7773
school*group*time	s1	Control	pre	15	51.6	12.0226
school*group*time	s1	Video Mode Comics	post	15	69.8	20.9598
school*group*time	s1	Video Mode Comics	pre	15	52.6	16.3786
school*group*time	s2	Book mode comics	post	15	46.8667	11.4384
school*group*time	s2	Book mode comics	pre	15	37.2667	12.2034
school*group*time	s2	Control	post	15	48.3333	14.2261
school*group*time	s2	Control	pre	15	41.1333	7.9361
school*group*time	s2	Video Mode Comics	post	15	53.0667	11.1064
school*group*time	s2	Video Mode Comics	pre	15	39.2667	7.116
school*group*time	s3	Book mode comics	post	14	52.5	14.4315
school*group*time	s3	Book mode comics	pre	14	41.0714	11.958
school*group*time	s3	Control	post	14	45.0714	10.2015
school*group*time	s3	Control	pre	14	44.4286	9.1628
school*group*time	s3	Video Mode Comics	post	15	51.9333	9.9676
school*group*time	s3	Video Mode Comics	pre	15	43.2667	13.2151
school*group*time	s4	Book mode comics	post	15	48.4	13.3084
school*group*time	s4	Book mode comics	pre	15	37.4	12.1055
school*group*time	s4	Control	post	15	44.8667	12.1999
school*group*time	s4	Control	pre	15	38.2667	12.6912
school*group*time	s4	Video Mode Comics	post	15	53.9333	12.2909
school*group*time	s4	Video Mode Comics	pre	15	34	9.2195

9.5 Addendum E: Student's consent form

	9.5.1.1.1.1.1 STELLENBOSCH UNIVERSITY

ASSENT FORM FOR MINORS



Research Topic: Testing the effectiveness of teaching and learning with video and book comics in Grade 4 Science classrooms

Researcher's Name: Malakia Haimbangu

Researcher's Contact Number: 0812537636

What is RESEARCH?

Research is something we do find NEW KNOWLEDGE about the way things (and people) work. We use research projects or studies to help us determine more about children and teenagers and the things that affect their lives, their schools, their families and their health. We do this to try and make the world a better place!

What is this research project all about?

The purpose of this study is to look at how teaching and learning with comics in Grade four classroom may benefit students by improving their school performance.

Why have I been invited to take part in this research project?

You are chosen to take part in this research project because your school is one of the schools selected to represent all the schools in the region.

Who is doing the research?

I am Malakia Haimbangu, working as a Senior Education Officer in the Omusati Regional Directorate of Education, Arts and Culture, responsible for Physics, Chemistry and Physical Science subjects. I am also a PhD candidate in Education Policy Studies at Stellenbosch University in South Africa.

What will happen to me in this study?

If you decide to be part of this study, this is what will be expected from you:

You will be taught using one of the three different teaching methods

You will write two tests, one before the class activity and another after the class activity

Can anything bad happen to me?

There are some things about this study you should know. This study requires you to learn through new classroom environment. This may make you uncomfortable. Be assured that you will not be expected to do what you have not been doing at school. If you may happen to feel uncomfortable or at risk of any kind during your participation in this research, you shall notify the teachers or the researcher. Some students will be left without a chance of getting potential benefits of participating in comics enriched teaching that should result in better learning results in Science subjects. Therefore, a recommendation to let these students get exposed to this project after the study is carried out will be in place and given to the teachers.

Can anything good happen to me?

I think that this study may benefit you although not all participants benefit from research. The word benefit means something good happening to you. These are some of the benefits you may get from this research study: students may perform well in Science and the research results may help the teachers of Grade Four build a strong foundation of science in students while they are still at primary level.

If you do not want to be in this research study, I will tell you what other kinds of treatments there are for you.

Will anyone know I am in the study?

When we are finished with this study, I will write a report about what you learned. This report will not include your name or that you were in the study. Your participation in this study will be kept confidential, but information about you will be given to the study supervisor to evaluate the project.

Who can I talk to about the study?

If you have any question regarding to this project, you can contact your Science teacher, the school principal, or the researcher (My Number is 0812537636).

What if I do not want to do this?

You can refuse to take part even if your parents have agreed to your participation. You can also stop being in the study at any time without getting in trouble.

Do you understand this research study and are you willing to take part in it?

YES		NO	

Has the investigator answered all your questions?

YES		NO	

Do you understand that you can STOP being in the study at any time?

YES		NO	

If you decide you want to be in this study, please sign with a date on the spaces below.

_____ _____

Signature of Child Date

9.6 Addendum F: Parents' Consent Form (English)

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PARENT/LEGAL GUARDIAN CONSENT FOR CHILD TO PARTICIPATE IN RESEARCH

Dear Parent(s)/ Guardian(s)

I would like to invite your child to take part in a study conducted by Malakia Haimbangu, Senior Education Officer in Ministry of Education, Arts and Culture, Omusati Directorate, and current PhD candidate in Education Policy Studies at Stellenbosch University. They happen to be possible participants because they are students in a Science class of selected Primary Schools in Omusati region. The title of the study is: Efficacy of video and book comic instruction in Grade 4 Science classrooms. Please take some time to read the information presented here, which will explain the details of this project and contact the investigator if you require further explanation or clarification of any aspect of the study.

1. PURPOSE OF THE STUDY

   The purpose of this study is to investigate the efficacy and challenges of comic instruction at Grade 4 in Omusati Region.

2. WHAT WILL BE ASKED OF YOUR CHILD

   If you consent to your child taking part in this study, the researcher will then approach the child for their assent to take part in the study. If the child agrees to take part in the study, he/she will be asked to:

1. He/she will be taught using one of the three different teaching instructions.
2. He/she will write two tests, one before the intervention and another after the intervention.

3. POSSIBLE RISKS AND DISCOMFORTS

This study requires the children to learn through new classroom environment. This may make them uncomfortable. Parents and children should be assured that children will not be expected to do what they have not been doing at school. If children may feel uncomfortable or at risk of any kind during their participation in this research, Children shall notify the teachers or the researcher. Children in the active control group (children taught the same method they are used to) will be left without a chance of getting potential benefits of participating in comics enriched teaching that may result in better learning results in science subjects. Therefore, a recommendation to let these children get exposed to this instruction after the study is carried out will be in place and given to the teachers.

4. POSSIBLE BENEFITS TO PARTICIPANTS AND/OR TO THE SOCIETY

The immediate benefit of this study will be the improvements of the academic performance in all Grade Fours that will use comics as a learning tool. The research results will help redirect the way of teaching Grade Four so that students will gain a strong foundation in science while still at primary level. It is documented that students who effectively develop their cognitive skills while at lower grades may excel well at higher grades.

The research results will encourage and open an opportunity for material developers for Grade Four and other lower grades to consider comics as one of the teaching strategies in elementary schools. The comics that will be produced during this project will be used as a specimen and a model for future instructions. The product will motivate the cartoonists,

video makers and animators to venture in producing the relevant comics that are interpreting the syllabus effectively.

5. PAYMENT FOR PARTICIPATION

No payment will be made to the child for taking part in this study.

6. PROTECTION OF THE CHILDS' INFORMATION, CONFIDETIALITY AND IDENTITY

Any information about the child that will be in the hands of the researcher during this study and that could possibly identify him/her as a participant will be protected. Each participant will be given a pseudonym to ensure utmost anonymity and confidentiality. The raw data will be kept in a locked file cabinet and electronic information will be kept in the password-protected computer or Microsoft One-drive Cloud for at least five years before it is destroyed permanently. Test sheets will be incinerated (burned) and a secure shredder will be used to delete electronic data.

The information obtained from this study will be shared with the supervisor and examiners for the purpose of evaluation and grading. The information collected for this study may be used for future publications. You have the option to let your child opt-out of his/her information being shared or published.

As the results of this study might be published in the future, you should be assured that confidentiality and/or anonymity will be maintained in the publications. Hence, the information that will be obtained from your child are for research purposes only and would be treated with the utmost confidentiality.

The test results that will be obtained from the child are for research purposes only and would be treated with the utmost confidentiality.

7. PARTICIPATION AND WITHDRAWAL

You can choose whether your child will be part of this study or not. If you agree for your child to be part of this study, you may withdraw your child at any time without any

consequence or being affected negatively in any way whatsoever. This means, the participation of your child in this research is entirely voluntary and you are free to decline. You should know that your child may also refuse to answer any question he/she does not want to answer and remain in the study.

8. RESEARCHERS' CONTACT DETAILS

If you have any questions or concerns about this study, please feel free to contact Malakia Haimbangu at haimbangu.malakia@gmail.com or 0812537636 and/or the supervisor, Professor J.D. Jensen, at cmockey@sun.ac.za.

9. RIGHTS OF RESEARCH PARTICIPANT

Children may withdraw their assent at any time and discontinue participation without penalty. They are not waiving any legal claims, rights or remedies because of their participation in this research study. If you have questions regarding child rights as a research participant, contact Ms Maléne Fouché (mfouche@sun.ac.za; 0218084622) at the Division for Research Development.

If you are willing to have your child participate in this study, please sign the following Declaration of Consent and give the form back to the child to return the form to school the next morning.

DECLARATION OF CONSENT BY THE PARENT/ LEGAL GUARDIAN OF THE CHILD- PARTICIPANT

As the parent/legal guardian of the child I confirm that:

- I have read the above information and it is written in a language that I am comfortable with.
- I have had a chance to ask questions and all my questions have been answered.
- All issues related to privacy, and the confidentiality and use of the information have been explained.

By signing below, I _____ *agree* that the researcher may approach my child to take part in this research study, as conducted by Malakia Haimbangu

_____ _____

Signature of Parent/Legal Guardian Date

DECLARATION BY THE PRINCIPAL INVESTIGATOR

As the principal investigator, I hereby declare that the information contained in this document has been thoroughly explained to the parent/legal guardian. I also declare that the parent/legal guardian was encouraged and given ample time to ask any questions.

_____ _____

Signature of Principal Investigator Date

9.7 Addendum G: Parents' consent form (Oshiwambo)

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EDIMININO LOMUDALI/OMUTEKULI WOKANONA OPO KA KUFE OMBINGA MEPEKAAPEKO

Omudali/Omutekuli omufimanekwa

Ondahala okushiiva okaana koye opo ka kufe ombinga mepekaapeko olo tali ningwa ku Malakia Haimbangu, oo eli Omunambelewa omukulunhu mouMinisiteli wEhongo, Moshitopolwa shEhongo shaMusati yee oku li yoo omulihongi koshiputudilo shaStellenbosch, te li hongele oundokotola moinima yapamba ehongo. Okaana koye oke lihanga okakufimbinga mepekaapeko shaashi okeli okanafikola mongudu youdindoli pofikola oyo ili mongudu yaado da hoololwa moshitopolwa shaMusati. Oshipalanyole shoshinyangadalwa shepekaapeko osho: Elongo loudindoli mokulongifa oufeelema nomafano ouyolifi mondodo onhine. Alikana kufa efimbo opo uleshe omauyelele a djadjukununwa pedu, oo taa ka fatulula nawa moule kombinga yepekaapeko ile u ninge ekwatafano nomupekaapeki ngeenge owa pumbwa ouyelele wa wedwa po.

ELALAKANO LEPEKAAPEKO

Elalakano lepekaapeko olo okushipununa ouwa nomashongo oo taa dulu okuholoka ngeenge ovanafikola vomondodo onhine tava longwa noufeelema ile nomafano ouyolifi moshitopolwa shaMusati.

10. OKAANA KOYE OKA TEELELWA OKU PULWA SHIKE

Ngeenge owa yandje epitikilo opo okaana koye ka kufe ombinga mepekaapeko eli, omupekaapeki otaka fika yoo kokaana opo yoo nako ka yandje ediminino kutya nako

okaitavela yoo okukufa ombinga. Ngeenge nee okaana okayandje edimininino loku kufa ombinga, otaka ka teelelwa nee ka ninge oinima ngaashi:

3. Otaka ka longwa mokulongifa imwe yomoilongadalwa ili itatu
4. Otaka ka shanga oukonaakono vavali omanga inaka longwa nokonima eshi ka longwa

11. OMAUDO-NAI OO TAA DULU OKUHOLOKA

Epekaapeko eli otali ka etifa ounona ve lihonge veli momudingonoko upe. Eshi otashi dulu shiva ningife vakale inava manguluka. Ovadali nounona otamu kwashilipalekwa kutya ounona inava teelelwa vaka ninge osho va kala ihava ningi kofikola. Ngeenge ounona ova ka kala inava mangulukila osho tashi ka ningwa, ova teelelwa va yelifile ovahongi ile omupekaapeki. Ounona ovo tava ka longwa ngaashi hava longwa shito kovahongi vavo, otava ka pewa omhito ya sheywa opo yoo navo vadule okulongifa nokulikola omauwa oo taa hangika moufeelema nomoufano vouyolifi. Hano, elombwelo otali ka yandjwa kovalongi opo ounona aveshe vaka mone omhito yokulongwa noufeelema noufano vouyolifi.

12. OMAUWA OO TAA DULU OKUHOLOKA KOVAKUFIMBINGA NOKOVAKALIMO MOSHITOPOLWA

Ouwa womeendelelo tau monika okudilila mepekaapeko eli oo ounona tava piti nawa omakonaakono avo ondodo onhine konima shima va longwa noufeelema noufano vouyolifi. Oidjemo yepekaapeko otai ka vatela yoo okulundulula nghene ounona vomondodo onhine hava longwa opo va kale vena ounongo woudindoli wa tungilwa kemanya lakola omanga veli meengudu dopetameko.Osha didilikwa kutya ounona ovo hava kulu paendunge dopahongo omanga veli meendodo dopetameko ohave keshi endifa nawa mehongo lopombada.

Oidjemo yepekaapeko otai ka twa omukumo nokupatulula eemhito dovanduluki voinyangadalwa yomongulu yofikola meendodo dopedu eshi tava ka nduluka oinyangadalwa ili molupe loufeelema noufano vouyolifi. Oufeelema noufano vouyolifi ovo tava ka ndulukwa opo valongifwe pefimbo lepekaapeko, otava ka kala onga oshihopaenenwa shiwa osho tashi kalongifwa monakwiiwa. Oshidjemo otashi ka twa omukumo yoo ovafaneki, ovaningi voufeelema opo va hoolole omangeshefelo oku nduluka oufeelema noufano vouyolifi ovo tava tangumuna nawa omufindalongo noukeka.

13. OFUTO YEKUFOMBINGA

Kapena ofuto tai futwa ounona ovo tava kufa ombinga.

14. EAMENENOPO LOMAUYELELE ENASHA NOKAANA NOKUKWASHILIPALEKA KUTYA KAPENA OMUNHU OMUTIVALI TAKA SHIIVA EDINA LOKAANA ILE OKUMONA KUTYA OKAKUFA OMBINGA MEPEKAAPEKO.

Keshe ouyelele u na sha nokaana koye, onga okakufimbinga, oo tau kala meke lomupekaapeki oo tau dulu ngeno opo kadimbululwe, otau ka kala wa amenwa. Keshe omukufimbinga otaka pewa edidiliko olo tali ka longifwa ponhele yedina laye opo a ha dimbululwe nande okulye ndele oukwatya waye u kale meholeko nomeameno. Omauyelele aeshe opaembapila otaa ka tuvikilwa mokashikopa kena ekumba omanga omauyelele opaungoba taa ka tuvikilwa mokompiuta ina oshipatululo shopaenomola ile moMicrosoft One-drive oule weedula nhano omanga inau hanaunwa po. Eembapila doukonaakono otadi ka xwikwa po omanga oSecure Shredder tai ka longifwa okudima po omauyelele okomalungula.

Ouyelele tau di mepekaapeko eli otau ka tukulilwafanwa nomuwiliki wepekaapeko noshoyo ovo tava katalela nokuyandja oitwa koshinyangadalwa eshi. Ouyelele watoolwa po, otau dulu yoo okuya momanyanyangido monakwiiwa. Ouna oufemba okukeelela ouyelele unasha nokaana koye uha tukulilafanwe ile uye momanyanyangido.

Ngaashi naana shatongwa metetekelo kutya omauyelele otaa dulu okunyanyangidwa, omudali oto kwashipalekwa kutya ouyelele u na sha nokaana koye otau ka kala uli meameno nowaholekwa. Hano omauyelele aeshe taa ka dja mepekaapeko eli okuna sha ashike nehongo notaa ka filwa oshisho noku kala eli meholamo.

15. EKUFOMBINGA NOKUNINGULUKA

Oto dulu okuhoolola ngeenge okaana koye owa hala kakufa ombinga ile inohala. Ngeenge owa dimine opo okaana koye ka kufe ombinga, oto dulu yoo okuninguluka efimbo keshe pehena oshilanduli ile ngeno shikweetele oupyakadi washa. Eshi osha hala kutya, ekufombinga lokaana koye mepekaapeko eli eliyambo ashike na ou na oufemba wo ku anya opo okaana koye ka ha kufe ombinga. Shiiva yoo kutya okaana koye okena oufemba oku anya okunyamukula epulo olo inaka hala okunyamukula ndele natango taka kala ashike mepekaapeko.

16. OMAKWATAFANO OPANGODI OMUPEKAAPEKI

Ngeenge ou na omapulo kombinga yomapekaapeko aa ile pamwe omalimbililo, alikana manguluka ndele to kwatafana na Malakia Haimbangu ko email:haimbangu.malakia@gmail.com ile kongodi 0812537636 ile omuwiliki wepekaapeko, Professor J.D. Jensen, ko email: cmockey@sun.ac.za.

17. OUFEMBA WOMUKUFIMBINGA MEPEKAAPEKO

Ounona otava dulu oku ningulula ediminino lokukufa ombinga mepekaapeko itava pewa ehandukilo. Itava kufwa omaufemba avo omanga tava kufa ombinga mepekaapeko eli. Ngeenge ouna epulo lina sha noufemba wounona ngeenge tashi ya komapekaapeko, monafana na Ms Maléne Fouché (mfouche@sun.ac.za; 0218084622) koshitopolwa shomapendulepo omapekaapeko koStellenbosch.

Ngeenge ouna ehalo okaana koye ka kufe ombinga mepekaapeko, alikana, shaina eano lediminino tali landula ndele ofooloma toishuna kokaana opo ke yeetelele kofikola efiku tali landula.

EANO LEDIMININO LOMUDALI/OMUTEKULI WOKAANA PAMANGO

Onga omudali/omutekuli wokaana pamango ohandi koleke kutya:

- Onda lesha omauyelele a yandjwa pombada nokwa shangwa melaka olo handi udu nawa.
- Oinima aishe ya pamba oinima yopaumwene, noiholekwa nelongifo lomauyelele adja mepekaapeko okwa futululwa nawa.

Okushaina pedu, ame _____ Onda dimina kutya omupekaapeki ota dulu oku kufa okaana kange opo ka kufe ombinga mepekaapeko ngaashi naana tali ningwa ku Malakia Haimbangu.

_____ _____

Eshaino lomudali/Omutekuli wokaana Efiku

EANO LEDIMININO LOMUPEKAAPEKI *(DECLARATION BY THE PRINCIPAL INVESTIGATOR)*

As the principal investigator, I hereby declare that the information contained in this document has been thoroughly explained to the parent/legal guardian. I also declare that the parent/legal guardian was encouraged and given ample time to ask any questions.

_____ _____

Signature of Principal Investigator Date

9.8 Addendum H: Teachers' Consent Form

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CONSENT TO PARTICIPATE IN RESEARCH

You are invited to take part in a study conducted by Malakia Haimbangu, Senior Education Officer in Ministry of Education, Arts and Culture, Omusati Directorate and current PhD candidate in Education Studies at Stellenbosch University. You were approached as a possible participant because you are a teacher of Science at selected Primary Schools in Omusati region. The title of the study is: *Efficacy of video and book comic instruction in Grade 4 Science classrooms*. Please take some time to read the information presented here, which will explain the details of this project and contact the investigator if you require further explanation or clarification of any aspect of the study.

PURPOSE OF THE STUDY

The purpose of this study is to investigate the efficacy and challenges of comic instruction at Grade 4 in Omusati Region.

WHAT WILL BE ASKED OF ME?

If you agree to take part in this study, you will be asked to do the following:

You will participate in preparation of comics

You will teach students on selected topics from Grade 4 Science syllabus

You will answer some interview questions like:

a) What challenges did teachers encounter during preparations of the comics?

b) What are the limitations of using comic instruction in animation and book mode?

c) What are teachers' perceptions of reasons for the minimal usage of comics' instruction in classrooms?

d) How do teachers mitigate the identified challenges in the comics of teaching and learning?

POSSIBLE RISKS AND DISCOMFORTS

This study requires you to teach certain topics to a group of students. This may make you uncomfortable. Please, be assured that you will not be expected to do what you have not been doing. You will use the same teaching strategies you have been using throughout your teaching career. If you may feel uncomfortable or at risk of any kind during your participation in this research, please notify the researcher.

POSSIBLE BENEFITS TO PARTICIPANTS AND/OR TO THE SOCIETY

The immediate benefit of this study will be the improvements of the academic performance in all Grade Fours that will use comics as a learning tool. The research results will help redirect the way of teaching Grade Four so that students will gain a strong foundation in science while still at primary level. It is well documented that students who effectively develop their cognitive skills while at lower grades may excel well at higher grades.

The research results will encourage and open up an opportunity for material developers for Grade Four and other lower grades to consider comics as one of teaching strategies in elementary schools. The comics that will be produced during this project will be used as a specimen and a model for future instructions. The product will motivate the cartoonists, video makers and animators to venture in producing the relevant comics that are interpreting the syllabus effectively.

PAYMENT FOR PARTICIPATION

No payment will be made to you for taking part in this study.

PROTECTION OF YOUR INFORMATION, CONFIDETIALITY AND IDENTITY

Any information you will share with the researcher during this study and that could possibly identify you as a participant will be protected. Each participant will be given a pseudonym to ensure utmost anonymity and confidentiality. The raw data will be kept in a locked file cabinet and electronic information will be kept in the password-protected computer or Microsoft One-drive Cloud for at least five years before it is destroyed permanently. Interview sheets will be incinerated and a secure shredder will be used to delete electronic data. You will have an opportunity to review the audio-recorded tapes.

The information obtained from this study will be shared with the supervisor and examiners for the purpose of evaluation and grading. The information collected for this study may be used for future publications. You have the option to opt-out of your information being shared or published.

As the results of this study might be published in the future, you should be assured that confidentiality and/or anonymity will be maintained in the publications. Hence, the information that will be obtained from you are for research purposes only and would be treated with the utmost confidentiality.

PARTICIPATION AND WINTHDRAWAL

You can choose whether you will be part of this study or not. If you agree to be part of this study, you may withdraw at any time without any consequence or being affected negatively in any way whatsoever. This means, your participation in this research is entirely voluntary and you are free to decline. You should know that you may also refuse to answer any question you do not want to answer and still remain in the study.

RESEARCHERS' CONTACT DETAILS

If you have any questions or concerns about this study, please feel free to contact Malakia Haimbangu at haimbangu.malakia@gmail.com, 0812537636 and/or the supervisor, Professor J.D. Jensen, at cmockey@sun.ac.za.

RIGHTS OF RESEARCH PARTICIPANT

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research participant, contact Ms Maléne Fouché (mfouche@sun.ac.za; 0218084622) at the Division for Research Development.

If you are willing to participate in this study, please sign the following Declaration of Consent and submit the form back to the investigator.

DECLARATION OF CONSENT BY THE PARTICIPANT

As the participant I confirm that:

I have read the above information and it is written in a language that I am comfortable with.

I have had a chance to ask questions and all my questions have been answered.

All issues related to privacy, and the confidentiality and use of the information I provide, have been explained.

By signing below, I .....agree to take part in this research study, as conducted by Malakia Haimbangu.

....

Signature of Participant Date

DECLARATION BY THE PRINCIPAL INVESTIGATOR

As the principal investigator, I hereby declare that the information contained in this document has been thoroughly explained to the participant. I also declare that the participant has been encouraged (and has been given ample time) to ask any questions. In addition, I would like to select the following option:

	The conversation with the participant was conducted in a language in which the participant is fluent.
	The conversation with the participant was conducted with the assistance of a translator (who has signed a non-disclosure agreement), and this "Consent Form" is available to the participant in a language in which the participant is fluent.

…… ……

Signature of the Researcher Date

9.9 Addendum I: Pre-test

COMIC INSTRUCTION RESEARCH

PRE-TEST

Grade 4

TOPIC: Matter and Energy

Marks: 40

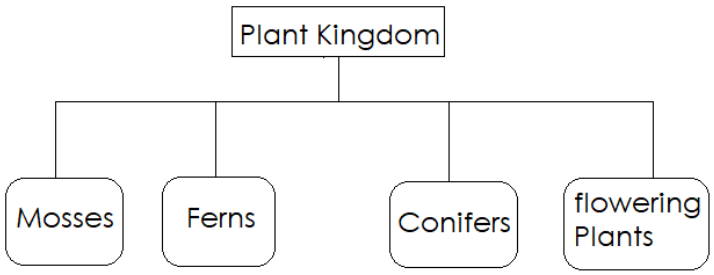
Duration: 45 Minutes

Instruction: Students answer on the Question Paper by encircling the letter of the correct answer. Do not write your name, instead, write the code that will be provided to you before you start taking the test. Answer all questions. Only the students with parents or parents' representatives' consent will be allowed to write this test. Apart from parents' and representative's consent, students should also mark with a tick on the box provided below to show their personal consent. A student has a right to opt not to participate in this activity or withdraw after starting.

Student Code: ……..

SECTION A

1. Select the name of the concept used to come up with the following diagram?



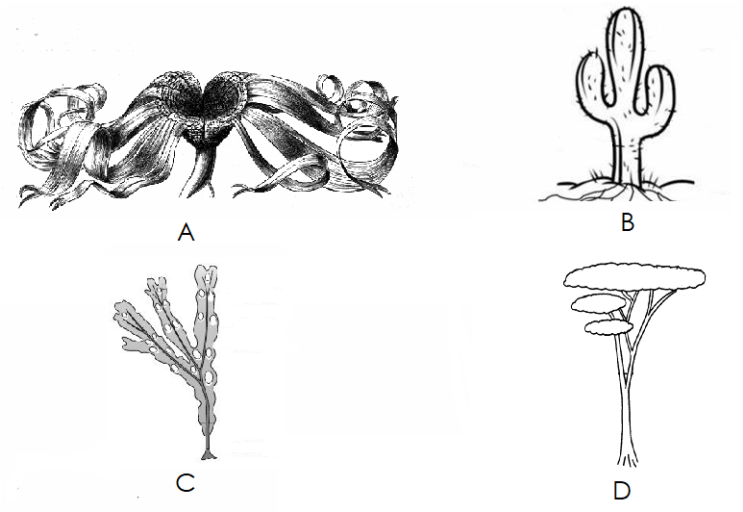
   A. Separation
   B. Integration
   C. Classification
   D. Identification

2. The interaction between living and non-living things is called:
   A. Diversity
   B. Ecosystem

C. Environment

D. Conservation

3. Which diagram below represents a plant that is found in the savannah ecosystem?



4. Plants need good soil for growth. Which type of soil is suitable for growing most plant varieties?

A. Loam

B. Sand

C. Clay

D. Silt

5. Which statement on clay soil is not correct?

A. Many plants grow well in clay soil

B. Clay soil does not have enough air

C. It holds a lot of water

D. Clay soil is fertile

6. Anything that occupies space and has mass is called:

A. Object

B. Living thing

C. Volume

D. Matter

7. One of the following is regarded as non-matter.

A. Air

B. Heat

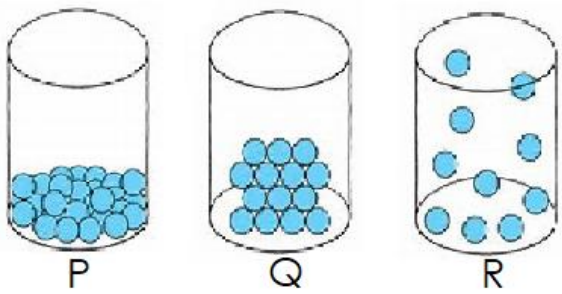
C. Water

D. Stone

8. Energy is recognised as non-matter because:
   A. It has no mass
   B. It has mass
   C. It occupies space
   D. It can be touched

9. A plant is categorised as a living thing because:
   A. It does not move on its own
   B. It moves on its own
   C. It grows
   D. It does not grow

10. Which statement about the states of matter shown below is correct?



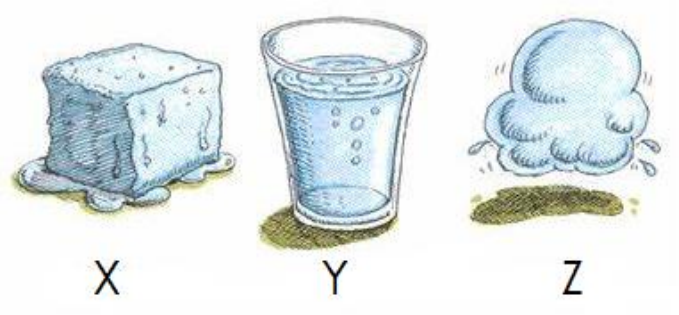
   A Diagram P shows the gas particles

   B Particles in Diagram Q are far apart from each other

   C Particles in Diagram R have a fixed shape

   D Particles for Diagram P and Q cannot be compressed

11. Water exists in three different forms. Choose the correct arrangement of the states of matter in the table with the pictures labeled X, Y, and Z.



	X	Y	Z
A	Solid	Gas	Liquid
B	Gas	Liquid	Solid
C	Liquid	Solid	Gas
D	Solid	Liquid	Gas

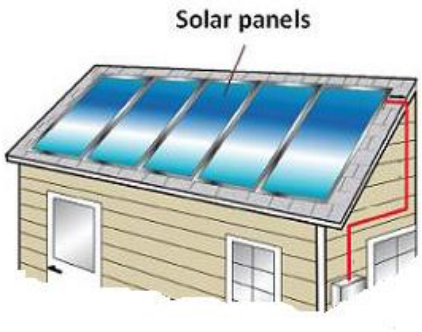
12. Which statement correctly defines sustainability?
    A. Permanent removal of trees to make room for something besides forest
    B. The prevention of the depletion of natural resources in order to maintain an ecological balance Awareness.
    C. The state of having a duty to deal with natural resources
    D. Concern about and well-informed interest in an environmental development

13. Which one is not a component of the water cycle?
    A. Precipitation
    B. Evaporation
    C. Drinking
    D. Condensation

14. The ability to cause a change in matter is:
    A. Power
    B. Energy
    C. Work

D. Force

15. A solar panel is used to collect energy from the sun and change it into other forms. The diagram below shows a house with a solar panel. What form of energy is collected by the solar panel?



A. Wind
B. Heat
C. Water
D. Light

16. The image below shows a boy running under a hot sun. Which form of energy does the boy retain?

A. Moving energy
B. Solar energy
C. Heat energy
D. Sound energy

17. Which one is known to be everywhere; in us, around us, in nature, light, wind, plants, and animals?
A. Water
B. Life

C. Energy

D. Power

18. The most important source of heat and light on earth is:

A. Firewood

B. Torch light

C. Light bulb

D. Sunlight

19. From which form of energy is the girl on a bicycle changing energy so she can ride?

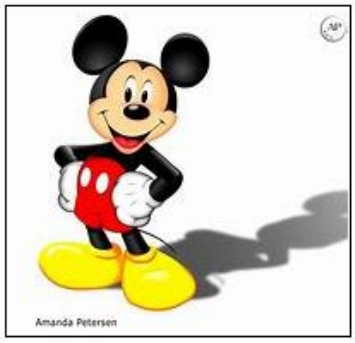
A. Chemical

B. Heat

C. Wind

D. Electrical

20. Mickey Mouse forms shadows when exposed to light, what makes objects form shadows?



A. Light is a form of energy

B. Light rays travel from the sun

C. Light travels in straight lines

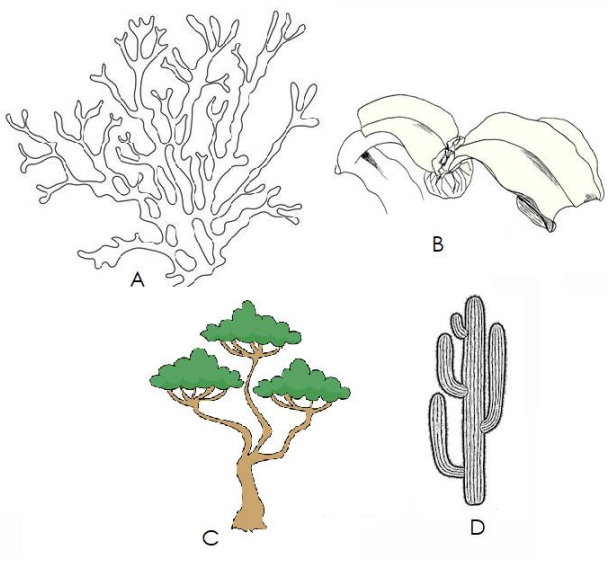
D. Light is absorbed by the object

SECTION B

21. The systematic arrangement in groups or categories according to established criteria is referred to:
    A. Integration
    B. Interrogation
    C. Classification
    D. Clarification

22. The biological community of interacting organisms and their physical environment is called:
    A. Interdependence
    B. Biodiversity
    C. Conservation
    D. Ecosystem

23. One of the things that differentiate one ecosystem from another is the type of plants found in it. Which letter in the diagram below represents a plant from the savanna ecosystem?



24. Plants grow well in the soil that has humus and holds water well. Which soil matches this description?
    A. Loam soil
    B. Clay soil
    C. Silt soil
    D. Sandy soil

25. Clay soil is one of the three major types of soil. Which statement below does not describe clay soil?

A. It holds a lot of water

B. Clay soil is fertile

C. Many plants grow well in clay soil

D. Clay soil does not have enough air

26. In Physics, anything that has mass and takes up space is called:

A. Living living

B. Matter

C. Volume

D. Object

27. From the list of things below, identify the one thing which is a non-matter.

A. Heat

B. Air

C. stone

D. Water

28. Non-matter is a form of energy. What made energy to be a non-matter?

A. It has mass

B. It occupies space

C. It can be touched

D. It has no mass

29. On Earth, things are categorised as living and non-living things. Why is a plant regarded as living thing?

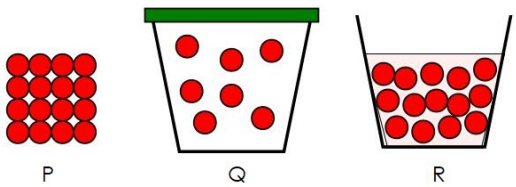
A. It moves on its own

B. It grows

C. It does not grow

D. It does not move on its own

30. Which statement about the states of matter shown below is correct?



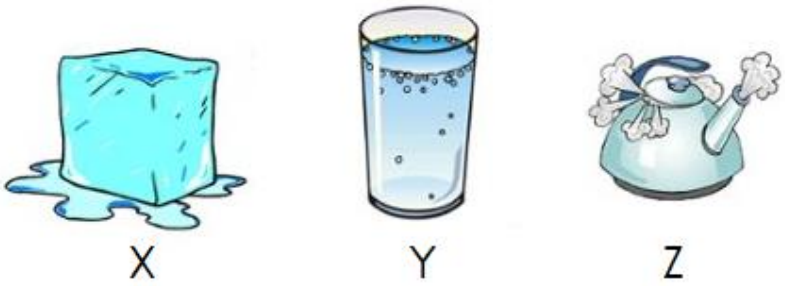
A Particles in Diagram Q have a fixed shape

B Particles for Diagram P and R cannot be compressed

C Particles in Diagram R are far apart from each other

D Diagram P shows the gas particles

31. Water can be found as a solid, liquid, and gas? Choose the letter that is correctly representing each diagram with the states of matter from the table.



	X	Y	Z
A	Solid	Gas	Liquid
B	Gas	Liquid	Solid
C	Liquid	Solid	Gas
D	Solid	Liquid	Gas

32. Sustainability is one of the terms that is mostly used in the modern world. Which statement correctly defines sustainability?

A. Permanent removal of trees to make room for something besides forest

B. The prevention of the depletion of natural resources in order to maintain Ecological balance Awareness

C. The state of having a duty to deal with natural resources

D. Concern about and well-informed interest in an environmental development

33. The water cycle is made up of several components. Which component below is not part of the water cycle?

A. Precipitation

B. condensation

C. Evaporation

D. Drinking

34. The ability to do something or to move something is called:

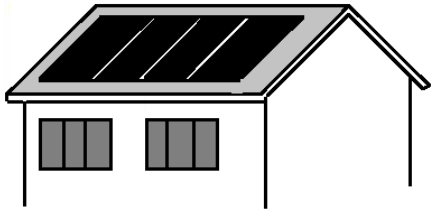
A. Force

B. Work

C. Energy

D. Power

35. Name the energy which is collected by solar panels that are fixed on the roof of the house below.



A. Water

B. Wind

C. Light

D. Heat

36. The image below shows a group of Grade 4 students jumping under the hot sun. What form of energy do they retain while jumping?

A. Sound energy

B. Moving energy

C. solar energy

D. Heat energy

37. Which one is known to be everywhere; in us, around us, in nature, light, wind, plants, and animals?

A. energy

B. Life

C. power

D. water

38. Which diagram shows the most important source of heat and light on earth from the diagrams.

A. Torch light
B. Fire wood
C. Sunlight
D. Light bulb

39. This duck has moving energy as it rides a bike, which form of energy is this moving energy changing from?

A. Heat
B. Electrical
C. Wind
D. Chemical

40. What made the students in the diagram below to form shadows?

A. Light is a form of energy

B. Light is absorbed by the object

C. Light rays travel from the sun

D. Light travels in the straight lines

It is the end of the test, thank you for taking part!

9.10 Addendum J: Post-test

COMIC INSTRUCTION RESEARCH

POST-TEST

Grade 4

TOPIC: Matter and Energy

Marks: 40

Duration: 45 Minutes

Instruction: Students answer on the Question Paper by encircling the letter of the correct answer. Do not write your name, instead, write the code that will be provided to you before you start taking the test. Answer all questions. Only the students with parents or parents' representatives' consent will be allowed to write this test. Apart from parents' and representative's consent, students should also mark with a tick on the box provided below to show their personal consent. A student has a right to opt not to participate in this activity or withdraw after starting.

Student Code: .....

SECTION A

1. According to established criteria the logical arrangement in groups or categories is referred to:

   E. Identification

   F. Classification

   G. Integration

   H. Separation

2. Which statement below correctly define the Ecosystem?

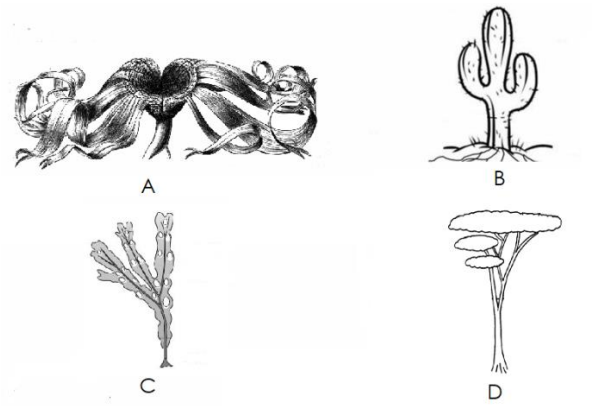
   E. The interaction between living and non-living things

F. The variety of plant and animal life in the in a particular habitat

G. Prevention of wasteful use of a resource

H. The surroundings in which a person, animals, or plants lives

3. Which diagram below represents a plant that is found in the marine ecosystem?



4. Plants need good soil for growth. Which type of soil is suitable for growing most plant varieties?

E. Loam

F. Sand

G. Clay

H. Silt

5. Which statement on clay soil is correct?

E. Many plants grow well in clay soil

F. Clay soil has enough air

G. It holds a lot of water

H. Clay soil is not fertile

6. Which statement defined matter correctly?

E. Anything with a tangible solid presence

F. The organisms which have life and show characteristics of life

G. Anything that occupies space and has mass

H. The measure of amount of space occupied by an object

7. Which one of the following is regarded as matter?

   E. Air

   F. Heat

   G. Sound

   H. Light

8. Which statement about energy is correct?

   E. It can be touched

   F. It has mass

   G. It can take up space

   H. It is a non-matter

9. Which one of the following is a non-living thing?

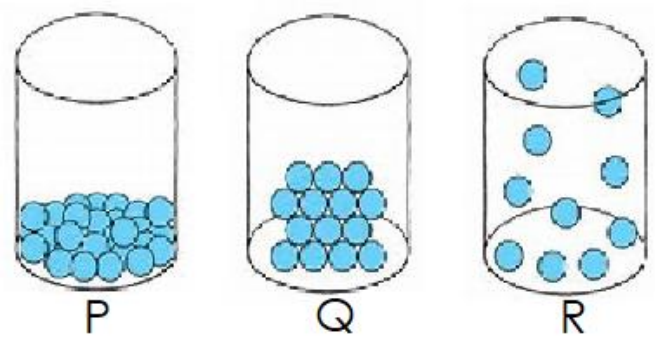
   E. Fish

   F. water

   G. people

   H. Grass

10. Which statement in the table describing states of matter represented by the diagrams is correct?



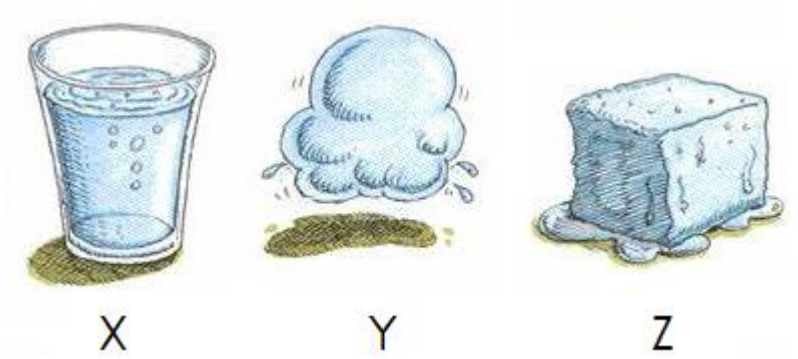
   A Diagram P represents solid particles

B Diagram R represents gas particles

C Particles in Diagram R cannot be compressed

D Particles in Diagram Q can flow

11. The diagrams below show the three forms of water. Choose the correct arrangement of the states of matter in the table with the diagrams labeled X, Y, and Z.



	X	Y	Z
A	Gas	Solid	Liquid
B	Gas	Liquid	Solid
C	Liquid	Gas	Solid
D	Solid	Liquid	Gas

12. Which statement shows how to use water sustainably?

E. Do not re-use water

F. Do not make sure the taps are closed after using them

G. Do not use a bucket when washing cars, instead use a hose pipe

H. Do not leave the water running while brushing your teeth

13. Evaporation is one of the components of water cycle. Which statement defines evaporation?

E. The process in which rain falls from the atmosphere

F. The process in which water vapour changes into water liquid

G. The process in which water liquid changes into ice

H. The process in which a water liquid changes into water vapour

14. The ability to do work is referred to:

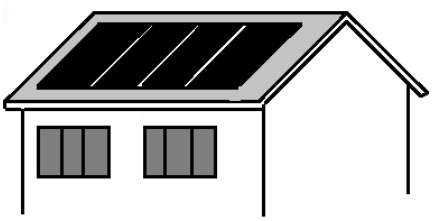
E. Speed

F. Time

G. Power

H. Energy

15. A solar panel is used to collect energy from the sun and change it into other forms. The diagram below shows a house with a solar panel. What form of energy do the solar panels change light energy into?



E. Heat

F. Electrical

G. Chemical

H. Moving

16. The image below shows a car driving on a hot road. Which form of energy does the car has?

E. Heat energy

F. Moving energy

G. Chemical energy

H. Sound energy

17. Which one is known to be everywhere; in us, around us, in nature, light, wind, plants, and animals?

E. Energy

F. Water

G. Air

H. Power

18. The most important source of heat and light on earth is:

E. Light bulb

F. Torch light

G. Sunlight

H. Fire wood

19. From which form of energy is the girl on a bicycle changing energy so that she can ride?

E. Chemical

F. Heat

G. Wind

H. Electrical

20. A man is resting in the shadow formed by a tree. What makes the tree form a shadow?

E. Light travels in straight lines

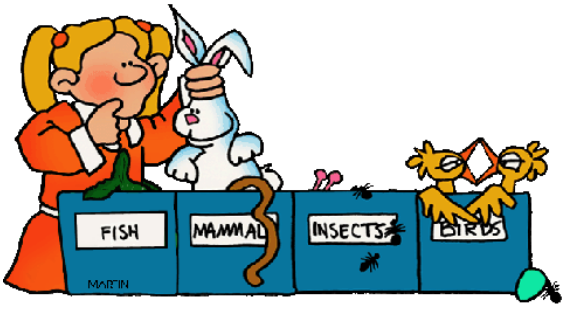
F. Light is absorbed by the tree

G. Light is a form of energy

H. Light is travels from the sun

SECTION B

21. The concept used by a man in the diagram below to arrange animals in groups according to their characteristics is called:



E. Division

F. Clarification

G. Interrogation

H. Classification

22. The biological community of interacting organisms and their physical environment is called:

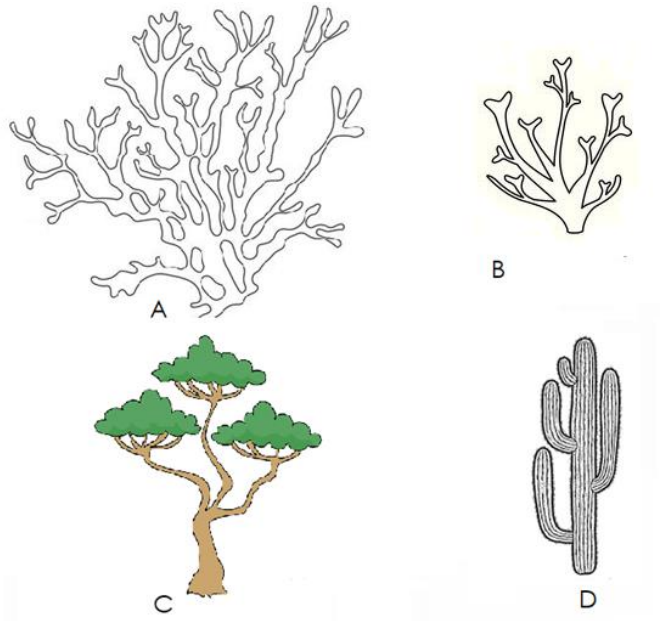
E. Interdependence

F. Conservation

G. Ecosystem

H. Biodiversity

23. One of the things that differentiate one ecosystem from another is the type of plants found in it. Which letter in the diagram below represents a plant from the savanna ecosystem?



24. Plants do not grow well in the soil which is not fertile and does not hold enough water. Which soil matches this description?

E. Silty soil

F. Loam soil

G. Sandy soil

H. Clay soil

25. Clay soil is one of the three major types of soil. Which statement below does not describe clay soil?

    A. Clay soil does not have enough air

    B. Clay soil is fertile

    C. Many plants grow well in clay soil

    D. It holds lot of water

26. In Physics, anything that has mass and takes up space is called:

    A. Living thing

    B. Object

    C. Matter

    D. Volume

27. From the list of things below, identify one thing which is a non-matter.

    A. Heat

    B. stone

    C. Air

    D. Water

28. Non-matter is regarded as a form of energy. What made energy to be a non-matter?

    A. It can be touched

    B. It occupies space

    C. It has mass

    D. It has no mass

29. On Earth, things are categorised as living and non-living things. Why is a plant regarded as a living thing?

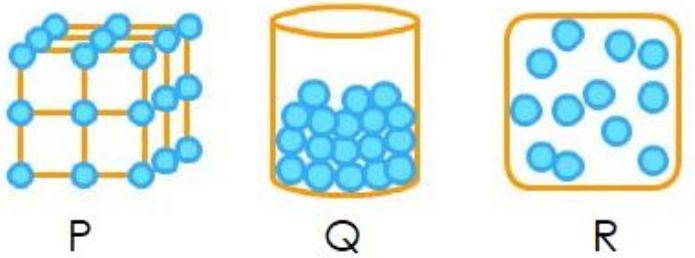
    A. It grows

    B. It does not grow

    C. It moves on its own

    D. It does not move on its own

30. Which statement about the states of matter shown below is correct?



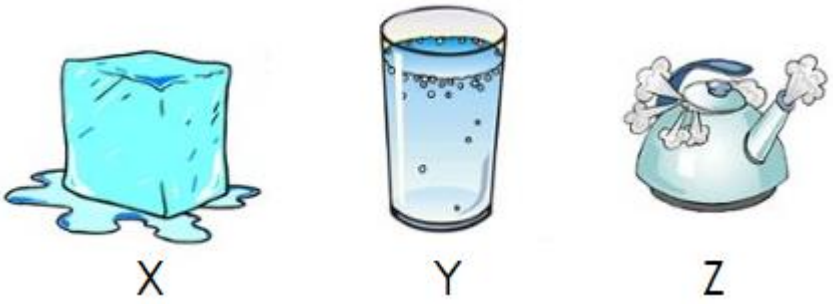
A Particles in Diagram Q have a fixed shape

B Particles for Diagram R can be compressed

C Particles in Diagram P are far apart from each other

D Diagram P shows the liquid particles

31. Water can be found as a solid, liquid, and gas? Choose the letter that is correctly representing each diagram with the states of matter from the table.



	X	Y	Z
A	Solid	Gas	Liquid

B	Gas	Liquid	Solid
C	Solid	Liquid	Gas
D	Liquid	Solid	Gas

32. Sustainability is one of the terms that is mostly used in the modern world. Which statement correctly defines sustainability?

A. Permanent removal of trees to make room for something besides forest

B. The state of having a duty to deal with natural resources

C. The prevention of the depletion of natural resources in order to maintain Ecological balance Awareness

D. Concern about and well-informed interest in an environmental development

33. The water cycle is made up of several components. Which component below is not part of the water cycle?

A. Precipitation

B. Drinking

C. Evaporation

D. Freezing

34. The ability to do something or to move something is called:

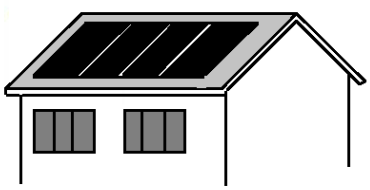
A. Energy

B. Work

C. Force

D. Power

35. Name the energy which is collected by the solar panels that are fixed on the roof of the house below.



A. Water

B. Wind

C. Light

D. Heat

36. The image below shows a dog running. What form of energy does this dog has while running?

A. Sound energy

B. Solar energy

C. Moving energy

D. Heat energy

37. Which one is known to be everywhere; in us, around us, in nature, light, wind, plants, and animals?

A. Water

B. Life

C. power

D. Energy

38. From the diagrams below, which diagram shows the most important source of heat and light on earth?

E. Light bulb

F. Firewood

G. Sunlight

H. Torch light

39. This duck has moving energy as it rides a bike, which form of energy is this moving energy changing from?

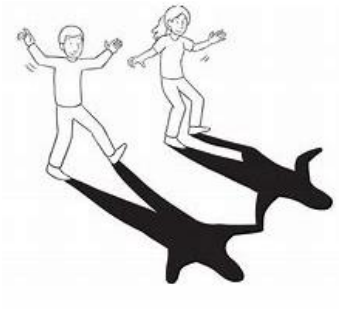
A. Heat

B. Electrical

C. Chemical

D. Solar energy

40. What made the students in the diagram below to form shadows?



A. Light rays travel from the sun

B. Light is absorbed by the object

C. Light is a form of energy

D. Light travels in the straight lines

It is the end of the test, thank you for taking part!

9.11 Addendum K: Test Validation Tool

TEST(S) VALIDATION

NATURAL SCIENCE AND HEALTH EDUCATION

GRADE 4

TOPIC(S): MATTER AND ENERGY

I am Malakia Haimbangu, a student at Stellenbosch University in South Africa. I would like you to help me validate my test instruments attached to this form for the purposes of collecting data for my dissertation. The tests are aimed at assessing the understanding of science concepts at Grade 4 level. Take time and evaluate the tests by completing the form below. *Note: The test item repetition is done intentionally for reliability testing purposes.*

Points of consideration	Yes	No
Do the questions unambiguously communicate the assessor's intentions?		
Does the test fairly cover the material tested?		
Is the difficulty level matching with the grade level?		
Are the test items appropriate for measuring the understanding of science concepts?		
Is the time provided adequate to take the test(s)?		
Does the test take care not to create identifiable pattern of answers?		
Do all students' abilities catered for in the test(s)		
Is the language usage appropriate with the students in Grade 4?		

General Comment:

.....

.....

.....

.....

.....

What is the overall impression of the comics?

Good		Not Good	

The Subject Expert's Signature: .....

Qualification(s): .....

Years of Experience: .....

9.12 Addendum L: Comics Validation Tool

COMICS VALIDATION

NATURAL SCIENCE AND HEALTH EDUCATION

GRADE 4

TOPIC(S): MATTER AND ENERGY

I am Malakia Haimbangu, a student at Stellenbosch University in South Africa. I would like you to help me validate my comics attached to this form for the purposes of interpreting the NSHE syllabus and present it to Grade 4 Science students. The comics are aimed at replacing the teacher's presentation of the lessons and enhance understanding of science concepts at Grade 4 level. Take time and evaluate the attached comics by completing the form below.

Points of consideration	Yes	No
Do the images and texts in the speech bubbles work together to communicate to the students?		
Does the comics fairly interpret the part of the syllabus under consideration?		
Are the illustrations arranged in a way that students can easily follow the sequence?		
Do the illustrations clearly give the clues to students on the character emotion, mood, and personality?		
Do the comics prepared in such a way that there is no age-appropriate moral, ethical, religious, or political themes that may offend or hurt the students?		
Is the information interesting enough to keep the students in Grade 4 actively engaged with the content?		
Are there enough supporting details to explain or describe each concept?		
Are there enough assessment and practical activities for student to try out or observe during the lesson presentation?		
Is the language usage appropriate with the student's in Grade 4?		

General Comment:

……

……

……

……

What is the overall impression of the test(s)?	Good		Not Good	

The Subject Expert's Signature: ……..

Qualification(s): ……

Years of Experience: ……..

9.13 Addendum M: Teachers' interview schedule

…….. (Date)

Interview Schedule

Comic Instruction in Grade 4 in Namibia Primary Schools

By

Malakia Haimbangu

Stellenbosch University

This interview is about the use of comics in the teaching of Primary School science.

SECTION A (Background information)

1. How many computers are at your school?
   A. 0 Computers
   B. 1-4 Computers
   C. 5-9 Computers
   D. 10 – 14 Computers
   E. More than 15 computers

2. What other technological devices do you have in your school?
   A. Television sets

B. Tablets

C. Smartphones (students)

D. Laptops

E. Smartboards

F. Other (Please specify) ……..

3. What is the status of the provision of internet at the school?

A. Excellent

B. Good

C. Average

D. Poor

E. No internet connection

4. How long have you been a Grade Four Science teacher?

A. 0-2 year

B. 3-5 years

C. 6-10 years

D. More than 10 years

SECTION B (General information on current affairs)

5. Which teaching methods have you been using to teach Science at Grade 4 level?
   A. Direct instruction (traditional teaching strategy)
   B. Inquiry-based instruction (participatory learning)
   C. Game-based learning (Experimental learning)
   D. Cooperative learning (Group work strategy)
   E. Flipped classroom (pre-recorded lectures)
   F. Kinesthetic learning (hands-on learning)

6. Grade 4 is a transitional grade from Mother tongue to English medium of instruction. What are the effects of the transition from Mother Tongue to English Medium on the teaching and learning of science concepts?

SECTION C (Comic instruction)

7. (a) Do you think comic instruction can help students learn science concepts effectively? Briefly explain your answer.

   YES: ☐ NO: ☐

   Give a reason to your choice.

   (b) Have you ever used comics during teaching in your life? (Before this program).

   YES: ☐ NO: ☐

   (c) If you have used comics, in what grade(s) and which year (s)? (Only if your answer is 'YES' in (b))

   Grade (s): ----------

   Year(s): ----------

   (d) And, if you have used comics as indicated in (c), what are your positive experiences with comic instructions?

   (e) If you never used comics during your teaching career, what were some of the limitations of using comics in instruction?

8. (a) What challenges do you as a teacher encounter during preparations of the comics?

(b) What challenges do teachers encounter in teaching while using comics in the Science classroom?

(c) What challenges do your students encounter while learning through comic instructions?

9. (a) Are students more or less engaged in the lessons with comic instruction comparing to other methods?

(b) Was the assessment more or less effectively addressed during the lesson with comic instruction?

(c) Were the practical activities more or less addressed during the lesson with comic instruction?

10. Do you know of any cartoon animator/video maker in your community? If your answer is 'Yes', how many animators/video makers do you know?

YES: ☐ NO: ☐

Number: ……

11. (a) What do you think are the limitations of using comic instruction in the video-mode?

(b) What are the limitations of using comic instruction in book-mode?

(c) What are your perceptions on the reasons behind the minimal use or none usage of comics' instruction in Namibian classrooms?

12. (a) How do you address the challenges that affect preparations and teaching using the comics?

(b) How do teachers address the challenges facing students while learning using comics?

13. Would you recommend other teachers/schools to use comic instruction at Grade 4 level?

I would recommend: ☐

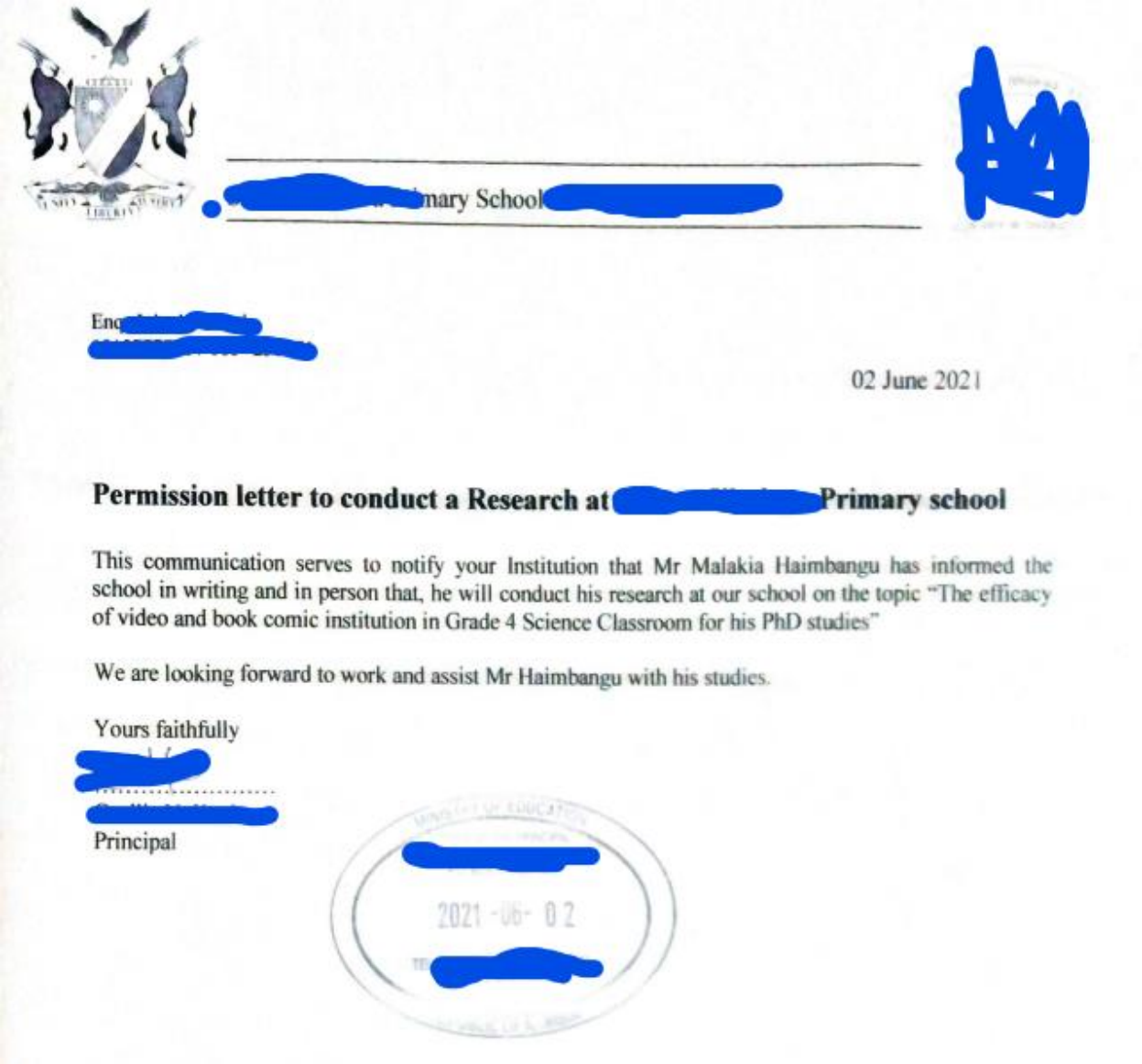
I would not recommend: ☐

Give reasons for your answer.

- END OF THE INTERVIEW -

- *THANK YOU FOR PARTICIPATING IN THIS INTERVIEW!* –

9.14 Addendum N: Permission Letters from schools



[redacted] mary School [redacted]

[redacted]

02 June 2021

Permission letter to conduct a Research at [redacted] Primary school

This communication serves to notify your Institution that Mr Malakia Haimbangu has informed the school in writing and in person that, he will conduct his research at our school on the topic "The efficacy of video and book comic institution in Grade 4 Science Classroom for his PhD studies"

We are looking forward to work and assist Mr Haimbangu with his studies.

Yours faithfully

[redacted]

.....

[redacted]

Principal

[redacted]

2021 -06- 02

[redacted]

REPUBLIC OF NAMIBIA
OMUSATI REGIONAL COUNCIL
DIRECTORATE OF EDUCATION, ARTS AND CULTURE

[redacted]

Enq [redacted]

SUBJECT: LETTER OF APPROVAL TO CARRY OUT A STUDY AT [redacted] PRIMARY SCHOOL

This communique serves to humbly inform your office that Mr Malakia Haimbangu is granted permission to carry out a study on the topic "The efficacy of video and book comic instruction in Grade 4 Science Classroom" at [redacted] Primary School.

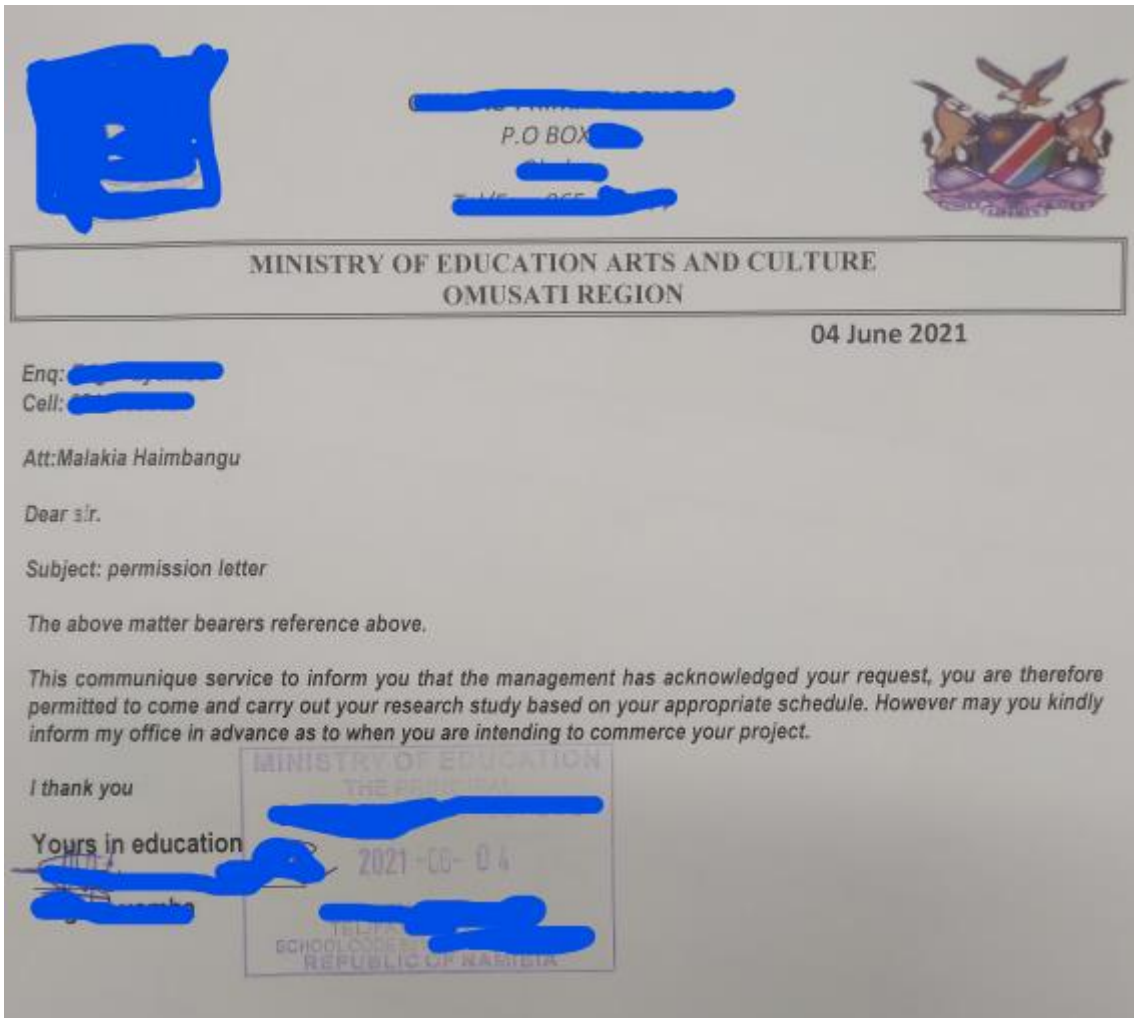
Should you need further information, kindly contact me at [redacted] or via email at [redacted]

Sincerely

[redacted]

MINISTRY OF EDUCATION, ARTS & CULTURE
2021 -06- 03
OMUSATI REGION

[redacted] PRIMARY SCHOOL
SCHOOL PRINCIPAL



[redacted]

P.O BOX [redacted]

MINISTRY OF EDUCATION ARTS AND CULTURE
OMUSATI REGION

04 June 2021

Enq: [redacted]
Cell: [redacted]

Att:Malakia Haimbangu

Dear sir.

Subject: permission letter

The above matter bearers reference above.

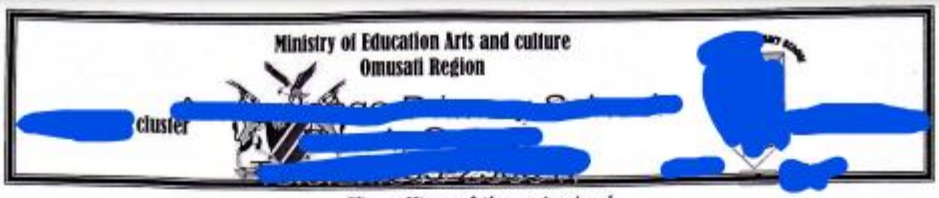
This communique service to inform you that the management has acknowledged your request, you are therefore permitted to come and carry out your research study based on your appropriate schedule. However may you kindly inform my office in advance as to when you are intending to commerce your project.

I thank you

Yours in education

[redacted]

MINISTRY OF EDUCATION
2021 -CO- 04
REPUBLIC OF NAMIBIA



The office of the principal

Enq: Mr. [redacted]
Cell: [redacted]

01st June 2021

To whom it may concern

Dear Sir/ Madam

Subject: Permission to carry out a study at our school.

This notes serves to inform your good office that Mr. Malakia Haimbangu is given a permission to carry out a study at our school on the following topic: The efficacy of video and book comic instruction in Grade 4 science classroom.

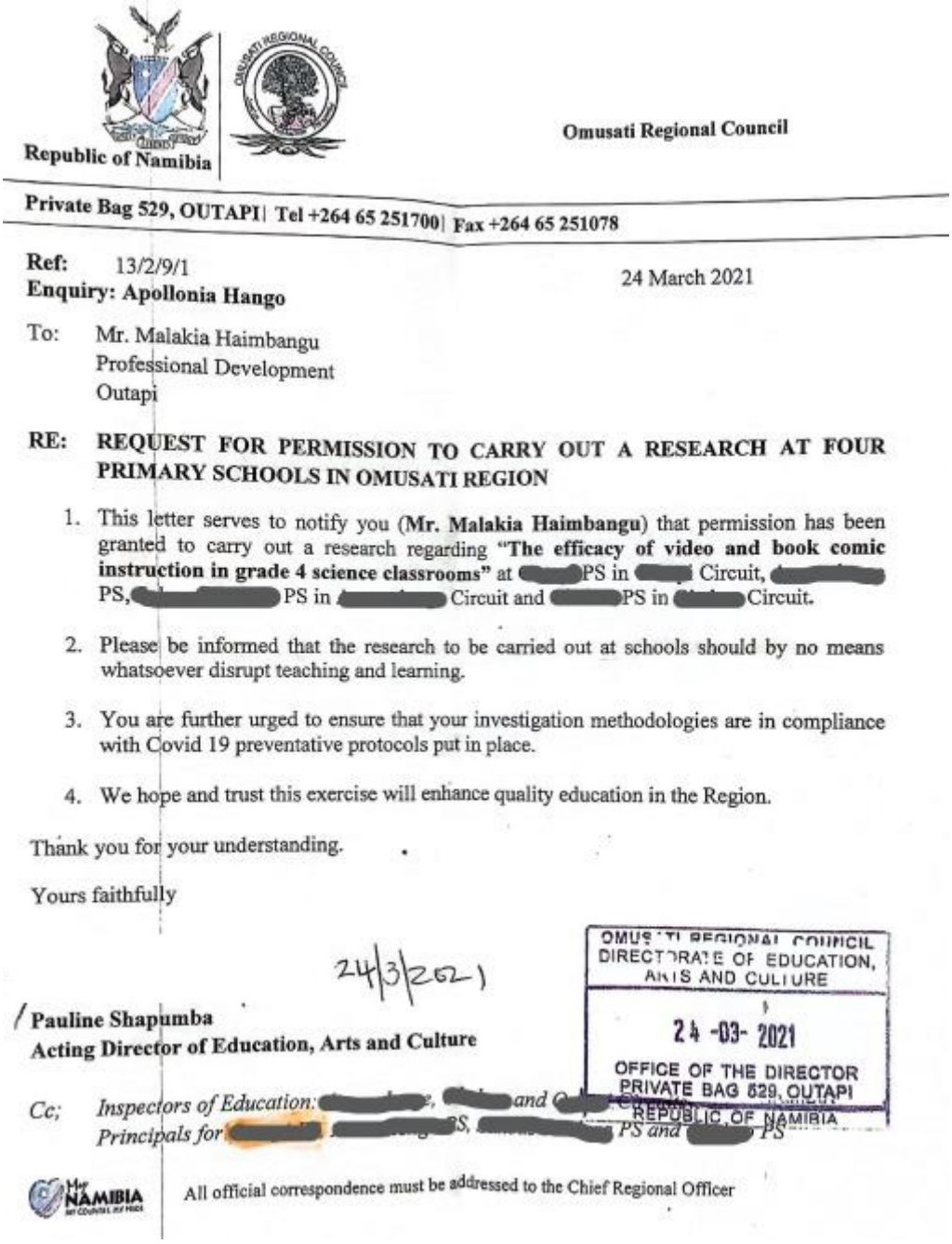
Thank you for your usual co-operation.

Yours faithfully

[redacted]

Principal

9.15 Addendum O: Permission Letter from The Regional Director



Republic of Namibia

Omusati Regional Council

Private Bag 529, OUTAPI| Tel +264 65 251700| Fax +264 65 251078

Ref: 13/2/9/1
Enquiry: Apollonia Hango

24 March 2021

To: Mr. Malakia Haimbangu
Professional Development
Outapi

RE: REQUEST FOR PERMISSION TO CARRY OUT A RESEARCH AT FOUR PRIMARY SCHOOLS IN OMUSATI REGION

1. This letter serves to notify you (**Mr. Malakia Haimbangu**) that permission has been granted to carry out a research regarding **"The efficacy of video and book comic instruction in grade 4 science classrooms"** at [redacted]PS in [redacted] Circuit, [redacted] PS, [redacted] PS in [redacted] Circuit and [redacted]PS in [redacted] Circuit.
2. Please be informed that the research to be carried out at schools should by no means whatsoever disrupt teaching and learning.
3. You are further urged to ensure that your investigation methodologies are in compliance with Covid 19 preventative protocols put in place.
4. We hope and trust this exercise will enhance quality education in the Region.

Thank you for your understanding.

Yours faithfully

24/3/2021

Pauline Shapumba
Acting Director of Education, Arts and Culture

OMUSATI REGIONAL COUNCIL
DIRECTORATE OF EDUCATION, ARTS AND CULTURE
24 -03- 2021
OFFICE OF THE DIRECTOR
PRIVATE BAG 529, OUTAPI
REPUBLIC OF NAMIBIA

Cc; Inspectors of Education: [redacted] and [redacted]
Principals for [redacted] PS and [redacted] PS

All official correspondence must be addressed to the Chief Regional Officer

9.16 Addendum P: Editor's Letter

FRANCI CRONJE
(PhD. Media Studies)
Author's Development Editor

Cell: 0825573647 Email: franci.cronje@gmail.com

Editor's Certificate

Date: 2 May 2023

To whom it may concern:

I hereby confirm that I have edited the PhD thesis:
The effects of video and book comic instruction on learning attainments in science classrooms in Namibia
Author: Mr Malakia Haimbangu

The author ultimately decided whether to accept or decline any recommendations made by the editor, and it always remains the author's responsibility to confirm the accuracy and originality of the completed work.

Signed:

Dr Franci Cronje
PhD (Media Studies); MA(FA); MPhil in Higher Education
Email: franci.cronje@gmail.com