

**An Investigation into the extent to which Grade 12 Mechanical Technology (MT)
Curriculum Practices relate to the Green Economy:**

A Case Study of Two Eastern Cape Technical High Schools

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ABSTRACT

South Africa's transition towards a green economy presents opportunities to create resourceful jobs that promote sustainable living in the long term. The country's educational sector is mandated to integrate a green economy component in curricula from primary schools to tertiary levels. However, green jobs within such an economy require green skills which are not necessarily being developed effectively through the school curriculum. This interpretive study investigated how curriculum practices in the Grade 12 Mechanical Technology (MT) stream offered by technical high schools prepare learners to participate in green economy opportunities in the Eastern Cape. Guided by Practice Architecture theory, the study analysed curriculum documents relevant to the Grade 12 MT stream. Teachers and past learners were interviewed to investigate the Cultural-Discursive, Material-Economic and Socio-Political arrangements that enable or constrain teachers in their intentions to prepare learners to participate in the green economy.

Teachers' material-economic arrangements constrained teaching and learning within the school premises. Learners did not have exposure to real-life fieldwork or job shadowing. Inflexible and restrictive socio-political arrangements in most subjects of the MT stream also constrained green economy learning opportunities. This hindered diversified learning in some subjects. The research further revealed that there is a need for updated pedagogical practices that are aligned with current educational practices. The research found that teachers had very little understanding of the green economy and broader environmental content in their subjects. Consequently, successful implementation of environmental content could not be achieved.

The research highlights the importance of advocating for the inclusion of green economy content in the curriculum practices of subjects in the Mechanical Technology stream. This could begin during teacher in-service training as this could enhance teachers' limited knowledge of environmental content. For practising teachers, workshops, seminars and possibly conferences are necessary to augment knowledge they have, including their awareness of local green economy opportunities in the Eastern Cape.

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LIST OF ACRONYMS

BERA	British Educational Research Association
CAPS	Curriculum Assessment Policy Statements
DBE	Department of Basic Education
GDP	Gross Domestic Product
GGP	Gross Geographic Product
GVA	Gross Value Added
HO	Head of Division
IDC	Industrial Development Corporation
KSD	King Sabata Dalindyebo
MT	Mechanical Technology
NCS	National Curriculum Statements
NEMA	National Environmental Management Act
NFSD	National Framework for Sustainable Development
NGP	National Growth Plan
NSS	National Strategy for Sustainable Development
OECD	Organisation for Economic Co Operation and Development
OR Tambo	Oliver Reginald Tambo
PAT	Practical Assessment Tasks
UNEP	United Nations Environment Programme

CHAPTER 1

INTRODUCTION

This introductory chapter introduces the research context and motivation for the study, presents the study's objectives and research questions, considers the significance of the study and its delimitations, briefly outlines the theoretical and methodological frameworks and, finally, provides a synopsis of the chapters that follow.

1.1 CONTEXT OF THE STUDY

The region of study, the OR Tambo District Municipality, lies in the southeastern region of the Eastern Cape province of South Africa. It is one of eight district municipalities of the Eastern Cape and covers about 80% of what was formerly known as the Transkei. The district is approximately 170.143 km from east to west and 121.725 km from north to the south. A rugged area, it is characterised by hills, sporadic forests and mountains with an average altitude of 764m above sea level. It extends over 15,946.84 square kilometres in the eastern coastal part of the Eastern Cape with homesteads dispersed along ridges and valleys on flat land (Paulus, 2007) (See Figure 1.1).

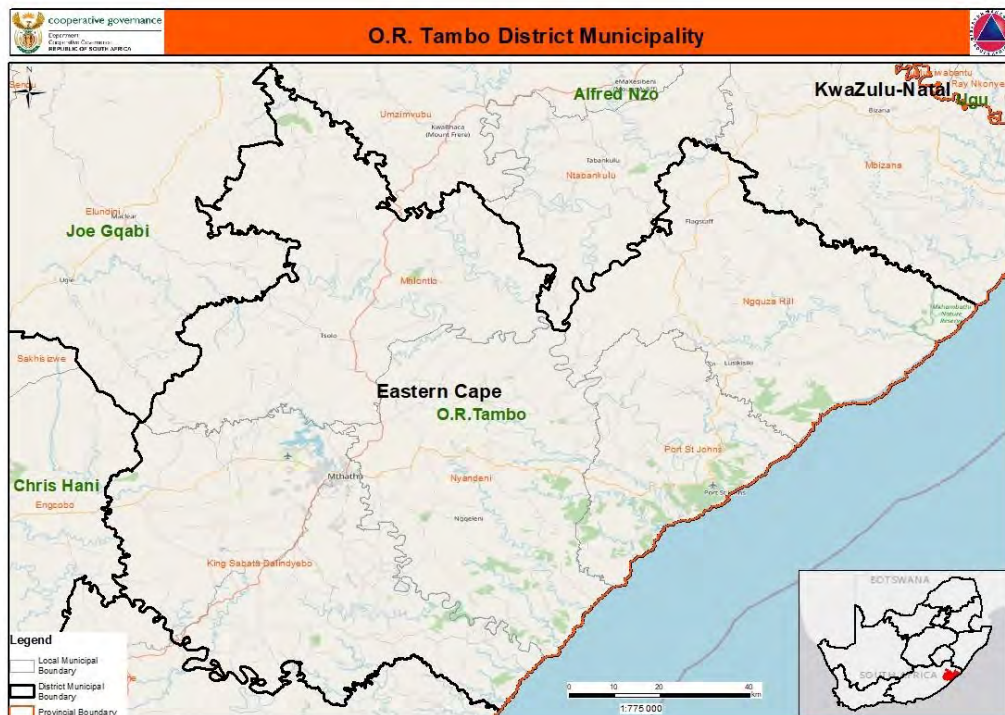


Figure 1.1: OR Tambo District Municipality: Eastern Cape (www.cogta.gov.za)

The OR Tambo District Municipality consists of five local municipalities: King Sabata Dalindyebo, Nyandeni, Mhlontlo, Ingquza Hill and Port St Johns. The major cities and towns in this municipality are Flagstaff, Libode, Lusikisiki, Mqanduli, Mthatha, Ngqeleni, Port St Johns, Qumbu and Tsolo (see Figure 1.2). With 1, 47 million people, or 21% of the total population in the Eastern Cape, the district ranked as the most populous district municipality in 2016. Nationally, the OR Tambo District Municipality housed 2, 6% of South Africa's population in 2016. Between 2006 and 2016, the population growth averaged 50, 94% per annum which is closer to half than the growth rate of South Africa as a whole, which is 54% (South Africa. Department of Cooperative Governance and Traditional Affairs [COGTA], 2017).



Figure 1.2: Five local municipalities of the OR Tambo District Municipality.(source: www.municipalities.co.za)

The OR Tambo District Municipality is one of South Africa's best-placed district municipalities for local economic development based on the identification, mobilisation and exploitation of local potential. The district is considered to possess natural resources and some of the most fertile land in the country that could potentially uplift the economic status of this district. The extensive 'Wild Coast' shoreline provides potential for tourism. It is an untapped

local asset that could promote the growth of tourism and attract foreign investments into the region that would lead to job creation and poverty reduction.

However, this municipality is also characterised by under-development, land degradation, droughts, downturn in the livestock sector, out-migration of labour, lack of economic development and investment and a struggling rural economy. Almost three decades after the fall of Apartheid, rural communities in the OR Tambo District are still plagued by high levels of poverty, which are more pronounced among black, rural and female-headed households in the former homelands of Ciskei and Transkei. Lack of capacity, corruption and conflicting interests between government, traditional leaders, business and hinder environmental sustainability and poverty eradication in this region and the province as a whole (Hamann et al., 2012).

The OR Tambo District Municipality lacks a major economic base. Active economic sectors include finance, community services, trade, agriculture, transport, manufacturing and construction. Agriculture remains the dominant backbone of this area with livestock rearing as its dominant activity. Unemployment and dependency on social security and pensions are high. In 2016, the community services sector was the largest within the OR Tambo district, accounting for R12,7 billion or 36,6% of the total Gross Value Added (GVA) in the district municipality's economy, followed by the trade sector at 23,3%. The finance sector was third at 21,1% (South Africa, COGTA, 2017). However, social development policy implementation continues to be the greatest challenge in this district municipality. The distribution of resources remains imbalanced. The only stable source of income for most of the population is the government grants shared by the extended families.

The number of unemployed people within OR Tambo district constitutes 16,96% of the total number of unemployed people in the Eastern Cape. 'Unemployed' refers to all persons between 15 and 65 who are currently not working but who are actively looking for work (South Africa, COGTA, 2017). This district municipality also experienced an average annual increase of 2,41% in the number of unemployed people, which is worse than that of the rest of the Eastern Cape Province which had an annual average increase in employment of 65% (South Africa, COGTA, 2017). In addition, the most developed economic hub of the OR Tambo District, the King Sabata Dalindyebo (KSD) Municipality, has been adversely affected by the following major socio-economic challenges:

- Limited skills base – functional literacy levels average 54% with 16% having matric only whilst 70% have post matric qualification. Even those who have post matric do not have the kind of skills required by the local economy in construction, agriculture and tourism.
- Limited private sector investments in critical sectors such as manufacturing, timber processing and agriculture
- General low-income levels worsened by elevated levels of poverty and unemployment.
- Infrastructure backlogs characterised by debilitating symptoms of poor maintenance and neglect hinder potential economic development. (Pretorius & Blaauw, 2008)

Opportunities for migrant labour in the province are limited and local sources of employment are retrenching workers. These declining opportunities for formal work have forced many households to turn to informal activities to obtain a sustainable livelihood. These include cropping, livestock farming and gathering of wild resources.

Studies done by Lahiff (2002) revealed that landlessness, vulnerability, unemployment, lack of basic services and rampant poverty have remained central to the lives of the majority of the population of the Eastern Cape for many years, dating back to the 1960s when the apartheid government created “native reserves” that came to be known as homelands or “bantustans”. Through relocation laws like the Group Areas Act there were forcible removals of black people into these homelands. The former Transkei, of which the OR Tambo district is part, was divided into tribal administrative areas that were dispensed to black people and towns and resorts that were reserved for whites (Kepe, 2001, p. 10). This resulted in overcrowding, out-migration of labour, poor public service delivery and lack of economic development and investment to the sections designed to be inhabited by black people. The resultant chronic poverty of the people led to enormous pressure on the natural resource base and the inability of most people to obtain a livelihood from the soil.

The prevalence of poverty amongst rural communities has been attributed to what is known as the “culture of poverty”. According to Collier (2007) in studies done by social theorist Carol Lewis as far back as 1968, the poor have a unique value system which makes them remain poor because of their adaptation to the burden of poverty. In these studies, by Carol Lewis, children born and raised in poverty are likely “to become poor adults and pass poverty onto their children” (CPRC, 2004, p. 39). These studies further claim that the poor are lazy and do not

want to work. As a result, the burdens of poverty become systematic, generational and are imposed upon members of society. This eventually leads to the establishment of an autonomous subculture where children are socialised into behaviours and attitudes that perpetuate their inability to escape from poverty. In Lewis' views, "the people in the culture of poverty have a strong feeling of marginality, of helplessness, of dependency, of not belonging. They are like aliens in their own country, convinced that the existing institutions do not serve their interests and needs. Along with this feeling of powerlessness is a widespread feeling of inferiority and personal unworthiness" (Lewis, 1968, p. 53).

Though Lewis' research is now over fifty years old, much remains relevant. For example, Collier (2007) stated that the culture of poverty tends to perpetuate itself from generation to generation because of its effect on children. By the time children who are born and raised in a slum reach the age of six or seven, they have usually absorbed the basic values and attitudes of this subculture of poverty. They do not see themselves living beyond poverty, taking advantage of changing conditions nor exploring betterment opportunities that may occur in their lifetime. The prolonged poverty in which these rural communities live has also resulted in enormous pressure on the natural resources, especially the land, and severely constrained people's ability to pursue livelihoods from the soil (Bundy, 1975, cited in Moletsane, 2012).

The education sector is recognised as having the potential to change the dire socio-economic plight of people in this region. Within the OR Tambo District Municipality, the number of people without any schooling decreased from 2006 to 2016 with an average annual rate of - 3,42% while the number of people within the "matric only" category increased from 68,300 to 115,000. The number of people with matric and a certificate/diploma increased with an average annual rate of 3,33% with the number of people with a matric and a bachelor's degree increasing with an average annual rate of 7% and 17% respectively. Within this district municipality, a total of 653,000 individuals were considered to be functionally literate. Functional literacy describes the reading and writing skills that are adequate for an individual to cope with the demands of everyday life especially those in the workplace. This functional literacy rate of 70,79% in 2016 is considered lower than that of the Eastern Cape which is at 77,18% (South Africa, COGTA, 2017).

With these literacy levels, it is necessary to further develop human capacity through education and training. Many learners in the OR Tambo District enrol in technical high schools every year with hopes and dreams of receiving an education that will improve their quality of life

through having the knowledge and skills to sustain themselves and their communities. This district has one TVET college, King Sabata Dalindyebo TVET college, as well as eight technical high schools. The curriculum taught currently in South African technical high schools includes subjects like Engineering Graphics and Design, Civil (split into Woodwork and Construction), Mechanical (split into Automotive and Fitting and Machining) and Electrical (split into Power Systems and Electronics) Technology which starts in Grade 10 and goes on to Grade 12. These subjects are known as ‘trades’ and they are aimed at producing learners who are independent, creative, have initiative and to some degree, are ‘tech-savvy’. To evolve with the changes and developments in the country’s economy, there is a need to include a comprehensive green skills component in these subjects to increase awareness of the importance of natural resource management, waste management practices, habitat rehabilitation programmes, water harvesting practices and many others. In the classrooms, workshops and laboratories, learners need greater awareness and understanding of the effect of their actions on the environment to change the practices that are harmful to their environment.

The extent of knowledge and skills acquired from these technical high schools may not be sufficient for life after matriculation. Jansen (2012) contends that the current South African education standards do not provide learners with enough conceptual knowledge and skills to prepare them for further studies or the world of work. It seems there is a mismatch between the curriculum and needs of the labour market. After completing school, many learners return to their homes and become entangled in a life of failed dreams, poverty, unemployment and, often, crime.

Borel-Saladin and Turok (2013) suggest that one of the strategies that could be used to address unemployment and poverty is exposing the learners to the green economy while also pursuing their livelihoods. As stated by UNEP, the educational sector has a mandate to integrate the green economy component from primary school up to tertiary institutions to increase awareness of the importance of conserving the environment. Furthermore, the specialised education offered by technical and vocational institutions can play an important role in reducing poverty and supporting economic growth but this requires the content of learning areas to be consistent with the needs of the labour market. The green economy and the green skills associated with it are elaborated in Chapter Two.

Do technical high schools prepare school leavers to participate in the available green economy opportunities in the Eastern Cape? This interpretative case study investigated how curriculum

practices in the Grade 12 Mechanical Technology stream offered by technical high schools are preparing learners to participate in green economy opportunities in the Eastern Cape.

1.2 INTEREST AND MOTIVATION FOR THE STUDY

As a languages educator in a technical high school, I believe that a country's economy does not grow if its young people continue to display inadequate skills and experiences necessary for employment. This study was motivated by an interest to investigate how the technical education post matric youth gain entry in green economy workspaces available in the province. As a developing country, South Africa is ideal for integrating green economy content in technical subjects, amongst others, which could create many resourceful jobs. The Eastern Cape has the potential for green jobs creation with abundant renewable energies from solar, wind, hydropower, biomass and waste materials, according to Renewable Energy Independent Power Producer Procurement (REIPPP, 2015).

Because there is a need for research-based understandings of classroom practices, this study investigates how cultural-discursive, material-economic and social-political arrangements enable or constrain teachers in their intentions to prepare learners to participate in the green economy space.

In order for these technical schools to fulfil one of their mandates of preparing learners for participation in the green economy through providing them with actionable knowledge and skills, there is a need for studies that focus on identifying existing challenges and resources to promote innovative thinking that will address socio-economic challenges. This study intended to generate ideas and recommendations that could support learners practically to participate in green economy opportunities in the Eastern Cape.

1.3 RESEARCH QUESTION

The study was framed by the following question:

In what ways do curriculum practices in the grade 12 Mechanical Technology (MT) subject stream prepare learners for the green economy?

The following research sub-questions guided the study:

- (i) What opportunities exist in the OR Tambo District for school leavers to participate in the green economy?
- (ii) What are the “sayings”, “doings” and “relatings” relating to the green economy in the curriculum practices of the grade 12 Mechanical Technology stream?
- (iii) What are the enabling and constraining factors that teachers and learners experience in the classroom when dealing with content related to green economy?
- (iv) What strategies might better orientate the curriculum practices of the Grade 12 Mechanical Technology stream to green economy opportunities?

1.4 OBJECTIVES OF THE STUDY

The objectives of the study are to:

1. To explore the opportunities that exist in the OR Tambo district for school leavers to participate in the green economy.
2. To investigate the enabling and constraining factors that teachers and learners experience in the classroom when dealing with green economy related content.
3. To find strategies that might better orientate curriculum practices of the Grade 12 Mechanical Technology stream to green economy opportunities.

1.5 SIGNIFICANCE OF THE STUDY

This study offers insights into technical education’s contribution to the integration of green economy content in the Mechanical Technology. Drawing on the empirical findings of two sites, the study makes recommendations that might strengthen green economy content in the curriculum and re-orientate the curriculum practices of the Grade 12 Mechanical Technology to green economy opportunities.

1.6 THEORETICAL FRAMEWORK

This study has been organised mainly within the framework of the theory of Practice Architectures. Kemmis and Grootenboer (2008) referred to this theory as an ontological lens

that can help us to understand how different practices – such as environmental and educational practices – emerge in cultural, material, and social contexts. According to Kemmis (2013), practice is a form of socially established cooperative human activity in which characteristics of material-economical arrangements (doings) are comprehensible in terms of relevant ideas in characteristics of cultural-discursive arrangements (sayings), and people and objects are distributed in socio-political arrangements (relatings). In this case the “sayings” would be the specialised language used in these practices by teachers, students and curriculum documents about green economy related topics and the curriculum. In other words, this refers to what teachers think and say about green economy in their learning spaces. The “doings” would be how the green economy content of the curriculum is enacted, taught, learnt and assessed, including any practical work, the physical spaces that are occupied, set-ups like workshops, available equipment and how it is set up in preparation for usage, resources involved and material available. The “relatings” refer to the roles, responsibilities, and relationships amongst teachers, learners, the curriculum, policies, the environment and economy in these two sites.

1.7. OVERVIEW OF METHODOLOGY

As a qualitative research design, this interpretive case study has utilised semi-structured interviews and document analysis. Selected school leavers and teachers from OR Tambo district participated in the study during the data generation stage from November 2018 to March 2020. Practice Architectures was the main theoretical lens used to guide data analysis.

1.8 SYNOPSIS OF CHAPTERS

This thesis consists of five chapters. This introductory chapter has presented the context and rationale of the study. Chapter Two defines key concepts framing the study and described work that has been done in South Africa regarding green economy and technical education. The chapter then introduces the Theory of Practice Architecture. Chapter Three provides a substantiated account of the research methods used to generate and later analyse the data. The findings of the analysis are presented in Chapter Four. In Chapter Five, I discuss these perspectives and experiences through the lens of the Theory of Practice Architectures towards presenting the study’s findings and making recommendations to strengthen green economy opportunities in the Mechanical Technology stream.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION TO GREEN ECONOMY AND GREEN SKILLS IN SOUTH AFRICA

Human health and well-being are intricately tied to the state of the natural environment. The Millennium Ecosystem Assessment (MEA, 2005), for example, reported very clearly how the so-called ‘services’ provided by ecosystems were essential to human well-being by providing provisioning, regulating and cultural services in the form of food, water, disease regulation, climate regulation, recreational and spiritual benefits, amongst many others. Despite this knowledge, the scale of global environmental degradation continues to worsen and the United Nations Environment (UNE, 2019, p. 4) reports that: “... over the last few decades, human activities, such as human-caused climate change and other human impacts on ecosystems, have transformed the Earth’s natural systems, exceeding their capacity and disrupting their self-regulatory mechanisms, with irreversible consequences for global humanity”.

In South Africa, economic growth and development are necessary for job creation and poverty alleviation. However, these activities have had a destructive impact on the environment. There are three key drivers of environmental degradation: production practices, consumption patterns and climate change. According to the Department of Fisheries, Forestry and Environment (2020), the key production processes in South Africa responsible for the destruction, depletion or degradation of the environment include: housing production that results in urban sprawl, fossil fuel-based electricity generation and transportation processes that result in greenhouse gases and other atmospheric emissions, agricultural and mining operations that destroy habitat and ecological infrastructure whilst polluting ground and surface water, and exotic forestry operations that destroy irreplaceable ecological infrastructure and habitat. Secondly, consumption rates and linear activities (extract-make-use-dispose) have increased resource exploitation beyond the recovery abilities of ecological systems. Inadequate and illegal practices include those related to food waste, e-waste, marine litter and crime (DFFE, 2020). Developed countries have policies in place to promote reduced waste and resource efficiency while developing countries still face basic management challenges such as uncontrolled dumping, open burning and inadequate access to services.

Lastly, the global climate is rapidly changing due to global warming and this has led to unprecedented climatic patterns and extreme weather events. This change on the earth's climate exceeds the ability of all types of ecosystems (marine, coastal, freshwater and terrestrial) to adapt as well as compromising their ability to function effectively (DFFE, 2020). South Africa is already a water-stressed country and we face future drying trends and weather variability with cycles of droughts that have led to increased occurrence of and severity of veld and forest fires and sudden excessive rains. In addition, there has been sea level rise that has affected coastal infrastructure, ocean acidification and changes in rainfall and snowfall patterns. Mass extinction of endemic plant and animal species will greatly reduce South Africa's biodiversity with consequent impacts on eco-system services. All of this significantly affects the human health, agriculture, mining, and electricity-generation sectors as well as the environment in general (DFFE, 2020).

If we do not look after our natural resources like water, and if we are unable to produce electricity sustainably, then we will not only lose future development opportunities, we will also lose the development opportunities and jobs we currently have. That is why it is important to 'green' our existing economy: without 'greening' the economy, or moving it to a more environmentally sustainable footing, we are going to intensify the risks to human well-being, including loss of economic activity.

A green economy aims to balance economic development with environmental conservation so that the needs of society, economy and environment can be met efficiently. This could possibly be achieved through prioritising green economy for job creation, poverty alleviation and reducing inequalities, while addressing global environmental concerns. At a global scale, green economy has gained international focus with new strategies, policies and discussions aimed at ways of restructuring the economies in a direction that is environmentally friendly. Green jobs are created to promote preservation or restoration of environmental quality. In essence, the proposed transition to green economy offers an opportunity for economic renewal, environmental protection and potential for job creation (ERLN, 2014).

The New Growth Path in South Africa, released in 2010, prioritises the green economy as an activity which could be viewed as a 'job-driver' with activities that "must provide an important entry point for broad-based black economic empowerment, addressing the needs of women and youth entrepreneurs and offering opportunities for enterprises in the social economy" (Economic Development Programme [EDD], 2010). This transition made by government

towards a green economy presents opportunities to create resourceful jobs that promote sustainable livelihoods especially for rural communities. South Africa considers the green economy as an opportunity to simultaneously address several socio-economic issues related to poverty, social justice and equality whilst attempting to balance natural resource use with these economic development needs.

South Africa recognises the green economy as a pathway to sustainable development and this gradual transition to the green economy has been internationally recognised as a groundbreaking way forward. The green economy model used in South Africa combines economic development, social welfare and environmental protection (DEA, 2014). As far back as 2014, extensive research was done on possible green economy job opportunities and the green economy sector has been identified to have considerable potential to promote green economy income generating and cost reduction activities to reduce poverty and improve community quality of life. These income-generating activities include community environmental services such as waste collection, sanitation janitorial schemes, wetland and green space management and alien clearing, recycling and other green development projects. Cost reduction activities include community gardening and agriculture, local composting and water leaks repairing, just to mention a few. These activities could be sustained through funding from local and district municipalities (DEA, 2014).

In addition, South Africa is party to several international conventions and agreements related to sustainable development, and has successfully engaged with multiple international green economy initiatives and programmes. Progress has been made towards investing considerable resources to address the key pillars of sustainable development and poverty eradication. The country has developed necessary legislation through environmental management or conservation acts, sustainable development strategies, skills development policies, biodiversity, air pollution and water acts. Sustainable development and green economy policies are enshrined in the following legislative framework:

- 1996 – Constitution of the Republic of South Africa
- 1998 – National Environmental Management Act (NEMA)
- 2008 – National Framework for Sustainable Development
- 2011 – National Strategy for Sustainable Development

- 2012 – Vision 2030 National Development Plan: Towards scaling sustainable Development Policy Action.
- 2013 – NEMA Amendment Act: Mainstreaming Environmental Management

National funding mechanisms have been drafted in consultation with relevant stakeholders, and green economy advocacy programmes have been established through provincial and local government initiatives and plans that support and complement the South African green economy framework (Nhamo, 2013). Evidently, there is a sound policy framework on the green economy in South Africa. However, for policy to be properly executed there must be enough funding, proper coordination and sound capacity to put all of this into practice. Moreover, there are notable successes that the green economy initiatives can be built upon, noteworthy being the Renewable Energy Independent Power Producer Procurement (REIPPP) programme that has set a global benchmark for renewable energy procurement. In 2011, the government introduced the REIPP programme as means of encouraging private capital to fund new sustainable power projects. Most of these projects use solar photovoltaic cells and wind technologies but also biogas, landfill gas, biomass and hydropower. So far, the programme has succeeded in using private sector investments and expertise to facilitate the development of grid-connected energy projects at highly competitive prices (Africa Progress Panel, 2015). Further successes can be attained through creating enabling environments from local to national levels that would encourage funding and sustained investments from both public and private sectors (ERLN, 2014).

The transition to an inclusive green economy in South Africa, however, has encountered challenges. The concept of green skills, which result from green economy, has been difficult to explain. The Organisation for Economic Co-Operation and Development (OECD, 2014) defines green skills as the knowledge, abilities, values and attributes needed to live in, develop and support a sustainable and resource efficient society. Green skills refer to the abilities, values and attitudes needed by humans to support the sustainable and effective utilisation of resources in the work place (Cox, Carta, Marangozov & Newton, 2012). The green skills which focus on the ‘green environment’ and energy are seen as intermediate to help preserve and conserve the environment through green technological industries (Dlimbetova, Zhylbaev, Syrymbetova & Aliyeva, 2016). In South Africa, Ramsarup and Lotz-Sisitka (2015) define green skills as any skills needed to take better care of the environment broadly and they are required for a broad range of jobs across a variety of segments of the green economy and

sustainable development. Upon expansion, this definition includes skills that are necessary to determine and manage water quality and demand, waste management, renewable energy and clean production. These skills are necessary for wastewater treatment works, engineering projects, sustainable farming, catchment management, business analysis, investment risk assessment, economic planning, procurement marketing and communications, health and safety monitoring, air quality inspection, labour representation, community development facilitation, teaching and more.

Each definition suits its appropriate context of use. This is because there are vested interests, power relations and hegemonic regimes involved. Numerous stakeholders influence how the green economy is conceptualised and implemented. These forces and regimes operate at various levels and are influenced by, for instance, internal party politics (Southall, 2010) and the minerals-energy complex (Peter & Swilling, 2011). The provision of green economy-type skills that are more technical and environmental conscious is necessary. A key enabling factor in economic growth is stable power supply and the drive to expand sustainable energy provision skills development has a crucial role to play (EWSETA, 2021). Such influences ultimately limit the interpretation and implementation of the green economy in South Africa.

Given the above constraints and challenges, there is a need for greater participation in and a wider formulation of what an inclusive green economy for South Africa may be. The country's green economy transition thus should be analysed in terms of 'what' or 'whom' is included or excluded, and 'where' efforts are focused (Montmasson-Claire, 2012). At first glance, the country seems to promote extensive social participation in the development of the green economy. However, the level of public participation in drafting the key texts that guide the implementation of the green economy has varied from being limited to becoming extensive, according to Montmasson-Claire (2012), indicating lapses in consistency.

Despite these challenges, South Africa possesses outstanding attributes that are conducive for this transition to the green economy. It is a middle-income country and an emerging market with well-developed modern infrastructure and dependency on its own diverse natural and mineral resources. The country has followed conservative fiscal policies which have allowed the economy to grow and spared South Africa from some of the worst global financial crises (Musyoki, 2012). However, the country is predominantly rural and economic inequalities are persistent among various population groups of the country. Since the political transition to democracy in 1994, there has been tremendous pressure from the government to address the

challenges of land, unemployment, poverty, crime and inadequate educational opportunities. The introduction of a green economy has been viewed as a means of lowering carbon emissions and as providing new employment opportunities. There are various initiatives to support green economy transition and subsequent poverty alleviation and community development programmes, namely:

- The Industrial Development Corporation (IDC) committed about \$3 billion to green economy investments over the period of 2010-2015.
- The Department of Economic Development has installed about 25,000 units of solar water geysers in low-cost houses both in urban and rural areas.
- Various departments have sponsored and started invasive species management and water supply programme, referred to as the Working for Water Programme, which employs rural women and youth to clear alien trees and plant species. (Musyoki, 2012)

Through these and other initiatives, South Africa shows growing interest and willingness to seize the opportunity provided by green economy to potentially contribute to economic development and promote sustainability of the environment while creating jobs for urban and rural communities as mentioned before. However, green jobs within such an economy require green skills that have not been developed effectively through the school curriculum. Technical education in South Africa can play an important role towards developing knowledge and skills in young school leavers that will enable them to enter the job market or create self-employment opportunities. By design, this type of education teaches learners topics and content that relates to practical or technical issues they encounter in their everyday lives. The next section considers the role that technical education has played in South Africa and highlights its significant contribution to the livelihoods of school leavers.

2.3 TECHNICAL EDUCATION IN SOUTH AFRICA

The demand for technical education in South Africa was a result of industrial development in the late 1800s. It was linked to mining and the development of railways, harbours and small engineering workshops. These infrastructural developments created a demand for railway technicians with appropriate technical skills, while in the mining industry engineers were in huge demand (Abedian & Standish, 1992). The supervisors acquired training through making

use of the British curriculum that was designed to oversee the construction and the maintenance of bridges, roads, public buildings, railway lines and ports. However, the workers were mostly illiterate. Schools were established to provide lessons in reading, writing, arithmetic, geometry and mechanics. Formalised technical and vocational education was introduced as training for individuals who show an interest in a particular field. By definition, education is the deliberate systematic and sustained effort to transmit, evoke or acquire knowledge, attitudes, values, skills and sensibilities and any learning that results from the effort, intended or unintended (Erasmus, Loedolff, Mda & Nel, 2014). It includes both organised and unorganised methods of transmitting information, skills and proficiencies. Since the beginning, the main objective of this education, according to Aring and Jurand (2012), was to provide conceptual knowledge and enhance the skills and abilities of individuals.

A technical school is a type of educational institution that may refer to secondary post secondary education that was designed to provide technical skills required to perform tasks of a particular or specific job. This includes learning activities that occur in an organization that are needed by managers and skilled and unskilled workers. Technical and vocational education leads to work in plumbing, carpentry, electric work, repair work, welding, production of artworks, handicrafts and many other areas. With this training, individuals are able to sustain their living as they work as electricians, painters, carpenters or repair workers. They are either employed with some organization or they have their own businesses or make visits to the households of individuals. The main objective of this education is the enhancement of skills and abilities. Academic high schools prepare learners who aim to pursue tertiary education whereas technical high schools are part of the school curriculum designed to make the learners enter directly into the workforce or be employable in at least one occupation with post-matric schooling that focuses on certain subjects. These subjects are Civil Technology, Mechanical Technology and Electrical Technology.

Education acquired by learners in a technical high school setting develops along two trajectories. After matriculating, one set of learners is prepared to enter the world of work because of having assimilated and developed knowledge, skills, values and understanding relevant to their field of study. The second set of learners pursues further training through TVET enrolment. Erasmus et al. (2014, p. 20) define training as “the planned acquisition of knowledge, skills and abilities to execute a specific task or job in a vocational setting”. It is task oriented because the focus is on work and based on a job or task requirements. These job requirements determine the training standards for a particular job. Vocational education

subjects are different from those offered in colleges or universities. Individuals normally select subjects based on their interest. For instance, if an individual is interested in repair work, then he may select this subject area within the training centre or a technical high school. After training has been attained, qualifications that indicate the depth of knowledge in specific area serve as an acknowledgement of having attained personal skills that allow individuals to meet job requirements and challenges that would occur in the workplace. These personal skills sets and knowledge need to be constantly developed so that trained workers can do their work to the best of their ability to ultimately achieve the organisation's vision and objectives (Mohapi, 2011).

The South African National Planning Commission (2011) recognises that: "Education has an intrinsic and instrumental value in creating societies that are better able to respond to the challenges of the 21st century". Higher levels of education, skills, research and innovation capacity are also required for:

1. The transition to a low carbon economy and meeting the greenhouse gas emission targets
2. Tackling health challenges
3. Developing new and existing technologies
4. Taking advantage of the opportunities that arise from economic growth (SANPC,2011).

Improving the skills and knowledge of the workers is crucial for achieving and maintaining economic competitiveness especially in the context of continued globalisation. These reforms are important for improving the skills supply and adapting these skills to new economic reforms such as the green economy in South Africa. These reforms are dependent on a proper vocational curriculum. This is because curriculum is the pathway to the development of professional knowledge and skills which facilitate the flow from theory to practice, as stated by Mouzakitis (2010). A good technical and vocational curriculum is of great benefit for individuals in the following ways: (a) it provides instruction for many different fields that require technical skills rather than academic knowledge; (b) it allows learners to gain knowledge and understanding; (c) it allows learners to focus solely on training for a career or related employment opportunities; (d) it allows learners to develop an enterprising attitude; (e) it allows learners to think creatively and independently; and (f) it provides flexible tasks and programmes from a variety of sources (Ellis, 2003).

There are many challenges that are facing post-school education and training around the world and in South Africa. Public and private providers of education and training do not serve rural youth well especially when one compares the opportunities available to urban youth. The OR Tambo District Municipality has been faced with sluggish deployment of teachers and other educational staff and personnel in this area. Poor quality of teaching, high schooling costs and rareness of good jobs are some of the causes of poverty in this district municipality. Education and training are often of inadequate quality, equipment and technology is outdated and teaching and training methods are ill-suited to rural contexts. Education has a lower level of priority compared to other pressing needs such as providing food security and job creation in this region. There is a link between poverty reduction and skills training and increased growth, productivity and innovation in particular for the informal sector, according to Fluitman (2002). Skills development improves output, quality, diversity and occupational safety and improves health, increases income and the betterment of the quality of livelihoods of the poor, as stated by Hartl (2009).

To address socio-economic challenges faced by the OR Tambo communities, technical high schools in this region need to produce learners with employability skills. An employability skill is an ability instilled in an individual to create a productive workforce, according to Kazilan, Hamzah and Bakar (2009). Preparations to acquire these skills begin when a learner is still in the learning process at school. Schools are institutions that prepare and facilitate the process to create potential and talent. Young people cannot take up the opportunities or create them if they are not aware of them or if they lack necessary knowledge, skills and competencies. Technical high schools by design are meant to train, discipline and reveal one's ability. After grade 12 these past youths enrol in colleges and universities where they will obtain skills and knowledge to meet present and future needs of the economy and society. There should be clear linkages between schools, TVET colleges, universities of technology, universities and other providers of education and training. This is crucial because the type of learners that come out of these institutions must be prepared for work. A young person cannot start waste recycling business if they do not understand how recycling works or if they cannot identify that gap as a business opportunity.

According to the National Curriculum Assessment Policy Statements (CAPS) (DBE, 2011), it is very important that institutions of learning must have a focussed approach to delivering relevant, quality education where learners will acquire and apply knowledge and skills in ways that are meaningful into their lives after schooling. On the basis of having identified skills

gaps, the curriculum needs to be able to differentiate the type of skills needed and interventions necessary for training in order to prepare learners to deliver required services in the workplace. Estevez-Abe et al (1999) distinguished three types of skills, namely (i) Organizational or firm-specific skills (ii) Industry specific skills and (iii) general skills. Organizational skills are acquired through on-the-job training and they are valuable to the employer who carried out the training but not to other employers. Industry-specific skills are acquired through apprenticeship and vocational schools. These skills, especially when they are authoritatively certified, are recognised by any employer within a specific trade. General skills as recognised by all employers carry a value that is independent from the type of firm or industry (Estevez-Abe et al, 1999).

When education is enhanced by introducing the latest developments in the curriculum about the country's economy, these schools will produce learners that will be of benefit to production of the country. Key to developments aimed at addressing these challenges, the government has embarked on expanding the provision of Technical and Vocational Education, with the main focus directed at ensuring growth in institutions that are already strong, while at the same time focussing on improving the quality of those who are struggling. The following section explains the Theory of Practice Architectures that frames this study.

2.4. PRACTICE AND THEORY OF PRACTICE ARCHITECTURES

2.4.1 Conceptualising 'practices'

Schatzki (2002) defined a practice as a temporally evolving open-ended set of doings and sayings linked by practical understandings, rules, teleoaffective structure and general understandings. This means that a practice comprises of doings and sayings called activities and these activities change as determined by circumstances and as they react to situations. These activities are events that happen in time and in space as determined by discourse and when they converge, they result in practices (Hemmis, Kemmis & Reupert, 2013).

2.4.2. Practices in the context of technical education

Practices in the technical education context by teachers include preparing technical education curricula, teaching the subject using specialised language, practical assessment tasks as well as assessment of learners' work in the form of baseline and summative assessment. Each of these practices involves its own sayings, doings and relating that hold it together. Schatzki (2012) stated that at the base of practices are those sayings, doings and relating that are basic activities

which, in the context of the Mechanical Technology curriculum, are often physical activities like writing, welding, reading, lab experimenting, grinding and others. These are the foundational activities that learners are expected to do. These basic activities develop into advanced activities like writing notes on important points of the subject, welding of panels as directed by the PAT requirements or grinding of metals as part of the learners' assessment prepared by the teachers. These are upgraded into developing higher level purposeful activities or teleological action hierarchies such as compiling concise notes on how to assemble steel gates, taking precautionary measures on welding and grinding, housekeeping using rule books on workshop, maintenance and safekeeping (Schatzki, 2012). The above tasks are completed by the learners with guidance and demonstrations from teachers or invited experts.

2.5 THEORY OF PRACTICE ARCHITECTURES

The Theory of Practice Architectures was conceptualised by Stephen Kemmis and Peter Grootenboer in 2008. This theory states that practices do not randomly occur anywhere but are fused with a variety of arrangements for these practices to be possible according to the needs of individuals operating within specific sites. These arrangements are sayings, doings and relatings. General and specific practices in sites always involve practitioners who interact with one another through language, people doing things collaboratively and relating to one another in particular ways. Ronnerman and Kemmis (2016) stated that practitioners in every practice are drawn to each other through (i) how they express themselves (sayings), (ii) how their actions are constrained or enabled within an environment (doings), and (iii) how practitioners interact with one another (relatings). At the core of this theory, according to Edwards-Groves (2018), is the importance given to these arrangements that enable or constrain practices at a given site. The diagram below represents what is entailed in the Theory of Practice Architectures.

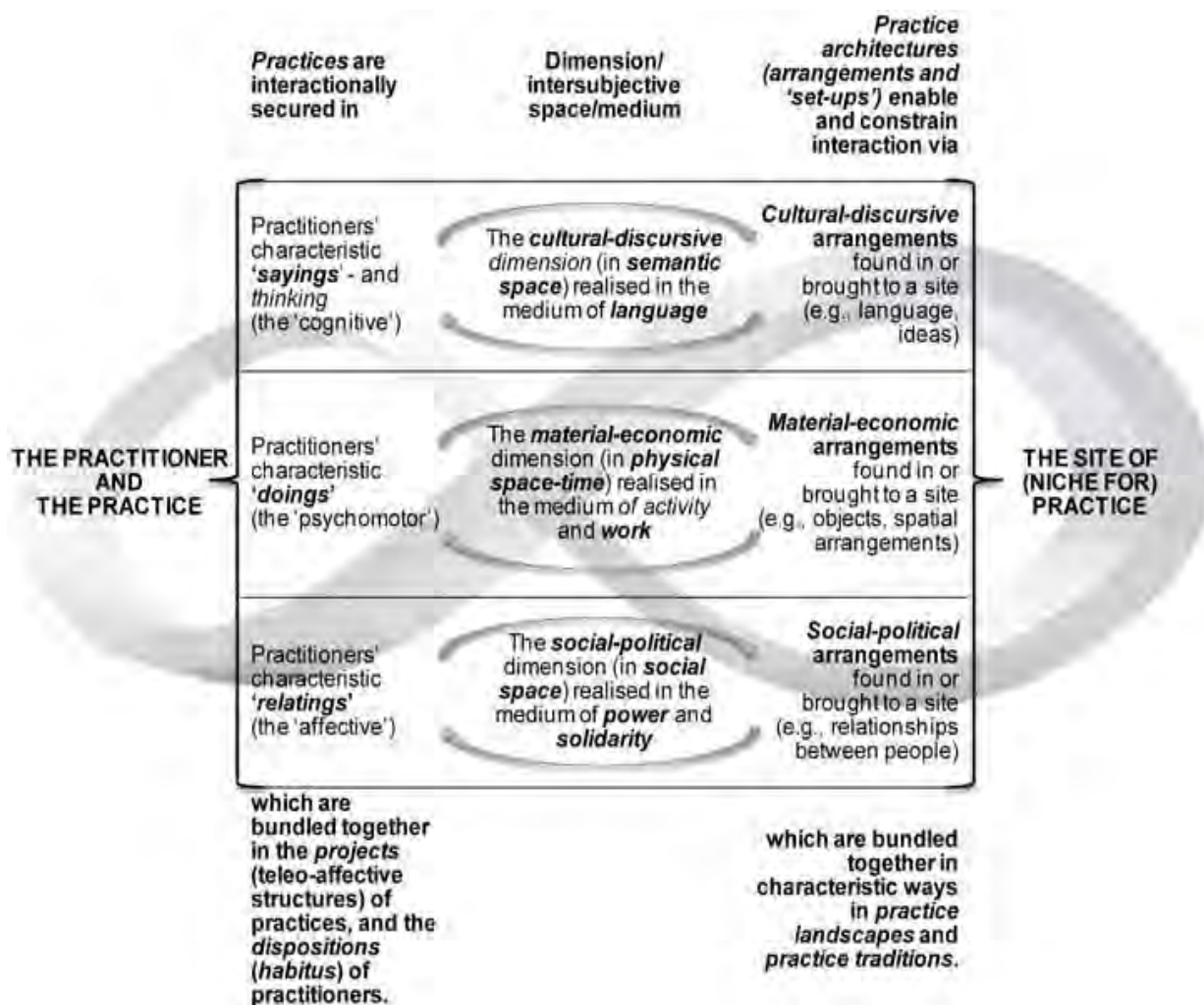


Figure 2.2: Theory of Practice and Practice Architectures
(adapted from Hemming, Kemmis and Reupert, 2013, p. 475)

2.5.1 'Sayings'

In terms of different professional practices, sayings involve particular ways of thinking about what the practices mean. Different kinds of practices involve their own characteristic discourses, conventional topics of thought and conversation as well as general ideas about the kinds of problems and issues they address (Goodyear, Casey & Kirk, 2017). When it comes to the “sayings” or discourse relevant to preparing technical education curricula in technical high schools, designing a subject chapter or unit involves participants communicating with one another using specialist discourses. For this research, the sayings would be the specialised language used in these practices by teachers, students and curriculum documents such as the

CAPS document about green economy related topics. This includes ideas about the kinds of activities that learners should engage in their subjects, ideas about the coverage of content in the field, ideas about learner competence and number of tasks for assessing the learners and ideas about examinations of these subjects.

2.5.2 ‘Doings’

According to Goodyear et al. (2017), different professional practices involve different and characteristic kinds of activities and work (doings) for professional practitioners and different kinds of activities and consequences for others involved in and affected by the practice. In my study, these ‘doings’ refer to how the green economy content of the curriculum is enacted and taught by the teachers, learnt by the learners and assessed by the teachers. In addition, this includes practical work, the physical spaces that are occupied, set-ups like workshops/laboratories/libraries, available equipment and resources as well as how it is set up in preparation for usage, financial resources involved and material available. Also, when preparing for a subject this involves different kinds of activities such as reading, planning weekly activities for the subject including field visits/excursions and job shadowing, Practical Assessment Tasks (PATs), assessment and marking the learners’ work.

A teacher teaching oil drainage or engine overhaul knows that it is important to use the relevant terms and phrases. The learners involved in preparing tools for dislocating the engine, draining the oil and re-assembling may not know anything about engine programming or mechanical engineering. Yet for them the project hangs together in a shared belief and in the justification that this project is worth doing (Kemmis & Mutton, 2012) – for the sake of improved car performance or prevention of dangerous fumes and with some level of understanding that the sequences of activities it involves are comprehensible and worthy of being learnt by these learners.

Certain discoveries are made during and after the PATs. Some of the tools used by the learners are borrowed from the neighbouring workshop within the school premises that is run by an independent car mechanic. This car mechanic comes with a wealth of experience in the motor industry since matriculating from the same school. He learnt engine overhaul and computer box programming from other car mechanics from nearby workshops. When invited to the school or when he allows the learners to do job shadowing at his garage, he shows and teaches them what are the correct tools, how machinery is programmed for the job, how it is assembled as well as how the workshop needs to be arranged. After a few demonstrations to the learners and clear instructions and guidance, they are left on their own to carry out the overhaul project

or oil drainage practical work. There is enough skill (doings) imparted to the learners so that even when they leave the school during holidays or after matric, they can fully carry out the job with minimum supervision.

2.5.3 ‘Relatings’

Different kinds of professional practices similarly involve different kinds of complex relationships between practitioners and those involved in and affected by these practices. There are different kinds of networks and communities of practice that are made and remade through the living connections that surround a practice (Goodyear et al., 2017). This involves a network of relationships between the person preparing the subject and others involved in the teaching, students taking the subject, departmental and school management team and SGB and relations with subject advisors. The relatings are roles, responsibilities, and relationships amongst teachers, learners, the curriculum, policies, the environment and the economy.

Relatings encourage networking and exchange of ideas within practices. Networks of relationships in subjects within the Mechanical Technology stream are established by the learners within these Practical Assessment Tasks (PATs). However, these networks are not only limited within the school but stretch further to other teachers in other learning areas, learners and teachers in the neighbouring schools and out in the community. The relatings involved in the PATs are not simply relationships between the learners. There are tasks, projects or practical work that involve relationships between the learners and the workshops they work in and as well as the teacher and these learners. Successful completion of these tasks depends on the nature and course of these relationships that involve students, teachers, subject advisors and policy makers.

Connecting this to this study, I share an example of Mechanical Technology (MT) as one of the subjects or trades in the MT stream. When a teacher talks about waste management after an experiment in a workshop during a Mechanical Technology lesson: -

‘Sayings might include:

- What the teacher says to the learners during the lesson about waste management;
- How, during the interview with the researcher, he explains waste management in relation to the curriculum and students’ skills and life opportunities;
- What the curriculum documents say about waste management-whether it should be taught and/or examined and how.

‘Doings’ might include:

- Whether the teacher practices or demonstrates waste management during or after lessons;
- Whether he includes this in assessment.

‘Relatings’ might include:

- How waste management relates to the rest of the content in the curriculum (e.g. is it contradicted by other context or practices i.e. it is not examined);
- Whether waste management is enabled by resources and wider practices at the school;
- Whether equipment has been provided for demonstration purposes;
- Whether waste management is included in teacher training, practical assessment tasks and other activities.
- Whether learners and teachers have strengthened their relations and ability to work together as groups and teams.

2.6 ENCAPSULATING THE THEORY OF PRACTICE ARCHITECTURES

Kemmis and Grootenboer (2008) referred to this theory as an ontological lens that can help us to understand how different practices – such as environmental and educational practices – emerge in cultural, material, and social contexts. Particular kinds of practices draw upon particular distinctive resources of language (sayings), particular distinctive kinds of activities (PAT, projects, and assignments) and particular distinctive kinds of relationships between people and between people and the natural world (relatings) (Kemmis & Grootenboer, 2008).

As an extension, Kemmis (2012) stated that practice architecture has three interdependent arrangements namely Cultural-Discursive arrangements, Material-Economic arrangements and Social-Political arrangements that hang together to create working conditions to enable or constrain particular practices. The Cultural-Discursive arrangements refer to what people know, think and say about a particular practice through specialised language that they use. This would include what policy documents (that is, the voice of government and curriculum experts) say. Secondly, there are Material-Economic arrangements which refer to the skills and habits

people have, the spaces and time they work in, what people do and resources that they have in that particular practice. Lastly there are Social-Political arrangements which manifest in the relationships among learners, teachers and learners, amongst teachers and amongst teachers and those on higher management positions (Kemmis, 2012). These arrangements are made, in part, by the previous practices of people in the site. However, they are not rigid and can be changed by people's practices as new knowledge keeps emerging.

These arrangements shape existing practices and development of new practices. Cultural-Discursive arrangements in the context of educational practice, as defined by Kemmis and Grootenboer (2008) refer to the "handed-down" educational knowledge and language acquired by the educators. This feature becomes evident in the sayings appropriate for describing, interpreting and justifying the practice, namely engine overhaul, handsaw, and drill in the case of Mechanical Technology terminology that is used.

Material-Economic arrangements are defined by Kemmis and Grootenboer (2008) as physical and economic arrangements that shape practices that practitioners engage in. They determine characteristic doings and work of the practitioners within the practice. For example, these would include available resources, workshops or laboratories, teachers' income and schools' and learners' socio-economic status, as suggested by Kemmis et al (2014). Among constraining material-economic arrangements in a school would be exorbitant school fees, absence of ramps for physically impaired learners, insufficient staff and other factors. Enabling factors would be free scholar transport, school nutrition programmes, staff, equipment and space. Loscher, Splitter and Seidl (2019) defined material economic arrangements as "specific constellation of material entities that gives meaning to the doings and sayings of a practice, while simultaneously providing meaning to the individual entities of the constellation" (p. 5).

There are four types of entities according to Schatzki (2002), namely (1) human beings as carriers of practices; (2) artefacts as objects formed by human activity; (3) organisms such as plants and animals; and (4) non-living elements of nature such as dams, rivers, mountains. The relations amongst these entities of material arrangements and practices manifests in the following, different ways. Firstly, activities within a practice change material arrangements (Schatzki, 2013). For example, a welder cuts steel bars with a grinder to make burglar bars. Secondly, activities within a practice react to events within an arrangement. The rotor blades of a wind turbine get broken by gale force winds and are replaced with new ones by technicians. Thirdly, an entity of a material arrangement is causally related to an activity within a practice

(Schatzki, 2013); this means people respond to certain stimuli. Learners enter the workshop and the artisan reads out housekeeping rules. Burst water pipes call for technicians to cut off water supply. Lastly, material arrangements prefigure a particular practice, according to Schatzki (2013). The teacher ensures equipment is sufficiently available before test or experiments are done by the learners in the lab.

Material-Economic arrangements manifest in the physical space through activity, resources and work as these make every practice possible. In order for some practices to be performed there need to be specific material arrangements. On-site service and repairs depend on the existence of space, technical skill and tools. A workshop with hand-held or foot-operated tools laid out on each table and a black board or a white interactive board at the front would be an example. This kind of layout determines a working exchange of information from the teacher to the learners. This is where the teacher or invited artisan or mechanic will demonstrate all the operations in the workshop under a well-managed and teacher-controlled environment. Furthermore, practices and material arrangements co-disseminate as stated by Schatzki (2013). For example, an Environmental Engineer requires dissemination of land so that she can monitor its use, pollution, resource regulation as well as environmental laws. According to Schatzki (2012), practices are linked to arrangements in many different ways and they hang together to form practice architectures. The performance of specific practice changes the meaning of material arrangements. This means a biological technician, for example, plants seeds, water plants and maintain their health in biological lab rather than using the lab for watching cartoons.

Socio-Political arrangements as stated by Kemmis and Grootenboer (2008) refer to the medium of power and solidarity which shape interactions in a particular practice and situate teachers into various relationships with learners, colleagues, community members, friends, partners and other interactions. This occurs in a social space like the classroom, school, workshop, laboratory, community halls and in many others. For example, this would relate to what is in the CAPS document on how and where learners in the specific trades must be taught as well as supervision by the HOD and subject advisors on how curriculum is to be implemented. This arrangement can be seen practically in the schools' rules, roles, and codes of conduct for learners and teachers. These are also found in the shared understandings and practical agreements about what to do in particular situations. For example, teachers who teach Mechanical Technology may agree that in order for learners to master the practical work that accompanies the subject, they need to do practicals at a local workshop with the assistance of experienced car mechanic. This could be endorsed by the CAPS documents that suggests that

Practical Assessment Tasks lead by successful learning as learner observe and engage practically with what they have been taught. It is not about theory but converting the theory into practice so that they can enhance their developing skills.

When incorporated with resources, tools, equipment, the socio-political arrangement of practice determine access to and considerations of ideas (Kemmis & Grootenboer, 2008). For example, learners with special needs tend to be treated differently rather than being integrated to the broader learner populations. Documented policy enables the inclusion of learners at any institution, but infrastructure becomes constraining factor.

This theory is useful when one examines the educational practices of practitioners. The language and concept of this theory is helpful for identifying constituents of practice and examining the conditions through which they are realised (Salamon, Sumsion, Press & Harrison, 2014). This theory enables practitioners to reflect on their everyday practices. For a practice to be set up and executed properly, the Cultural-Discursive, Material-Economic and Socio-Political arrangements must be properly placed according to the needs of the practice.

According to Salamon et al. (2014), this theory is context specific as it is grounded in the belief of the importance of practice and particular sites of practice and individual practitioners. Focus is on considering what accuracy does each context of sites require rather than making generalised requirements for various sites. Uchida, Cavanagh and Lane (2020) stated that the three dimensions of practice architectures theory interact with each other to produce a holistic picture of the complex function of social environments. For example, at school, a learner's relationship to his teacher (Socio-Political arrangements) may influence the extent to which this learner is able to gain entry in the computer lab (Material-Economic arrangement). So, this theory serves as a framework to investigate how individuals can shape and be shaped by physical, social and relational structures that bind school together as an operational whole (Uchida, Cavanagh & Lane, 2020, p. 4)

Practice Architectures theory in this research provides a framework for teachers to explore their own practices. For this study, the researcher was the practitioner and collects relevant data to evaluate how classroom practices prepare learners for green economy practices. This was done through interviews with participants and collectively as a team. How technical education and training teachers see and define their own field of practice is critical in the beginning to understand the arrangements that prefigure their teaching practices and that hold these practices in place while recognising that these Practice Architectures occupy the sites where the practices

happen. In this case, the site where the practices happen is generally the classroom as well as the workshops, laboratories and library for particular subjects. The teachers' views and explanations construct and support the narratives that technical education practitioners who are trade teachers in this case tell about themselves and about their discipline. These narratives can be seen as some of the Cultural-Discursive arrangements for the practice architectures of sites of technical education teaching and learning practices.

These Cultural-Discursive arrangements influence the Material-Economic arrangements and processes like work scheduling, workshop preparations, tool preparation, table arrangements, housekeeping in the workshop, what they are required to do out of class and assessment tasks. These narratives also influence the Socio-Political arrangements as the dominant transmission mode of teaching practice in technology studies (Gardner, Goldsmith & Vessalas, 2016). This relates to the interaction between learners, learners and teachers, interactions with other technical subjects' teachers, who they talk to, their relationships and other factors. Cultural-Discursive, Material-Economical and Socio-Political arrangements hold in place the practices of technical education teachers in the teaching of their subjects

The use of Practice Architectures theory and development of new practices are influenced by a variety of situated and contextual factors. Every practice done in classrooms is a result of a practice architecture consisting of language, materials and power relations. Practice Architectures are interdependent on each other and mainly rely on past experiences and previous knowledge brought by the teacher in the class. The new knowledge that is brought by the teacher is influenced and shaped by current and emerging practices. Within and beyond the classroom, the practices constructed in and by the schools, resources, people (learners, teachers, parents) hang together as is appropriate for that particular site.

So, the teachers don't use their personal resources when implementing their practices at schools. However, it is the personal and external resources e.g. learners, policies, associations that are interdependent and work together to construct and constitute practice. Goodyear, Casey and Kirk (2017) stated that practice architectures are based upon understandings of the connectedness between features of practice that exist at the site and how those features are embedded both in organisations and the social-cultural relations of teachers' work. In the sites that I am working on, these features include specialised technical education, curriculum, CAPS policies, labs or workshops for practical work, tools and machinery, staff, out-of-site sessions and many others. The social-political relations would be how learners relate to themselves,

teachers, the management and governors of the school, the work environment (labs and workshops) and CAPS documents specifications on curriculum implementation and delivery.

Through the use of Practice Architectures, practitioners can identify arrangements in their own sites of practice over which they have less or more control. In situations where they have no control such as class size, prescribed work schedule, room allocation, timetables, they can mitigate and shift their focus to aspects they can control like languages of teaching and learning, assessment of work, relations amongst learners and colleagues and other aspects.

In a school setting, Practice Architectures enable individuals to understand the structural frameworks in which teachers operate. Teachers see opportunities to be creative in what they offer but also recognise the risk that their credibility would have if these activities failed. Teachers don't simply teach to meet the needs of the school. They are constrained in what they can offer and how they can do this. Furthermore, nothing is fixed in what happens in the classroom and at the school. Learners enter the classroom with their own intended outcomes and so do the teachers. This happens no matter how changing or fixed the subject contents or curricula being taught or learned. This theory also gives insights into the inter-relationships between the different arrangements inherent in teaching and learning practices. Changes happening in one arrangement, e.g. the material-economic can affect other arrangements. However, these arrangements hold the practice together.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

In this chapter I describe the research methodology, processes and methods used to generate data for investigating how curriculum practices in the Grade 12 Mechanical Technology stream offered by technical high schools prepare learners to participate in green economy opportunities in the Eastern Cape. This chapter begins with a discussion of the case study methodology (see section 3.2), research sites and participants (section 3.3), followed by an elaboration of how data was generated through document analysis and semi-structured interviews (section 3.4). This is where methods are described and discussed regarding their suitability for this study and the processes followed to generate and store relevant data. The focus in section 3.5 is on data analysis and interpretation and section 3.6 provides some reflections on ethical consideration in educational research.

3.2 QUALITATIVE CASE STUDY

3.2.1 Features of qualitative case study in educational research

This study was designed as a qualitative case study. Yin (1994) defined case study as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not evident” (Yin, 1994, p. 13). Case study research is useful as it is a study of an instance or ‘case in point’. According to Cohen, Manion and Morrison (2011), a case study provides a unique example of real people in real situations where cause and effect relationships of particular events or issues in unique and dynamic contexts can be described: “Case studies strive to portray what it is like to be in a particular situation, to catch the close-up reality and thick description of participants’ lived experiences of, thoughts about and feelings for, a situation” (Cohen, Manion & Morrison, 2011, p. 290).

3.3.1. Selection of sites

Sampling is about carefully selecting a subset of a specific population that possesses similar qualities of the larger population being interviewed, without researching every component of the population. Purposive sampling was used in this research. Saunders, Lewis and Thornhill

(2012) defined purposive sampling as a technique in which the researcher relies on his or her own judgement when choosing sources of information and members of population to participate in the study. Even though this type of sampling is vulnerable to errors in judgment as well as bias and low levels of reliability, it is one of the most cost and time effective sampling methods available. Two sites were chosen by the researcher and useful data was obtained during the interviews. The Department of Basic Education has been visiting both technical high schools (the research sites) as they have been selected by national curriculum policy makers as sites for future skills training.

The criteria used to choose the two sites of study were:

1. I chose these sites because I have a personal connection with them. I work with colleagues from these sites, and already have a genuine interest in the schools, so I felt they would be a good starting point for my interviews, particularly as I would work repeatedly with these colleagues for the duration of my research. Secondly, these sites were easily accessible to me and the gatekeepers (principals and the district director) granted me permission to conduct the study. There were also activities (Practical Assessment Tasks) for me to further enhance my study. Thirdly, the communication would be easy because I am proficient in the languages spoken by learners and teachers in these sites. I have revealed the names of these sites throughout the research due to their relevance to the study and as there were no risks to the participants from these sites. I felt that the actual names would provide authenticity to my research. Anonymity of participants from these sites remained a priority.
2. Furthermore, within OR Tambo District, these two sites have a comprehensive trade and industrial education. This type of education trains learners for specific jobs in the skilled trade industry. Learners from these schools display a wide range of talents, interests and abilities in civil, electrical or mechanical technology streams. After their studies, especially hands-on training, they are prepared for actual work in their chosen fields of interest.
3. Lastly, vocational subjects differ from academic subjects in terms of activities and teaching methods employed during class. Vocational subjects require learners to use instruments, tools or equipment and other non-academic skills. They require many job skills which involve reading and writing skills, completing work on time, creative thinking and problem solving as well as teamwork skills. Evaluation of the vocational subjects is largely based on practical assessment tasks or performance tests rather than the written examinations

found in academic subject assessments. Grades are assigned based in part on the performance in schools' workshops though they do have teacher-developed tests.

3.3.2 Characteristics of the sites

(A) Mthatha Technical College

This institution is located along the rural periphery of Umtata on the R61 regional road on the way to Port St Johns. It is a public state school established in 1983. It is equipped with workshops and modern-day equipment offering a wide range of vocational and occupational learning opportunities. In this site, I conducted interviews with six teachers (one of each of the seven subjects offered in the MT stream) as well as nine former learners who matriculated between 2015 and 2018.

(B) Ikwezi Technical Skills Centre

This school was initially established as a vocational oriented skills training centre. However, vocational training was moved to the nearby King Sabata Dalindyebo Technical and Vocational College. The school retained its name, but the curriculum was reformed to be oriented towards a technical education. Established in 1983, it is situated in the peri-urban Ikwezi township in Umtata within the King Sabata Dalindyebo local municipality in the Eastern Cape.

The Department of Basic Education has been visiting these technical high schools as they have been selected by national decision-makers as sites for future skills training. Currently, these sites are offering technology and commercial stream of study where students have a choice of studying isiXhosa Home Language, English First Additional Language, Technical Maths or Pure Mathematics, Technical Sciences or Physical Sciences, Life Orientation, Accounting, Business Studies/Tourism and Economics; alternatively, they choose Civil Technology, Electrical Technology and Mechanical Technology. However, from 2019 they can specialise solely on technology related streams to prepare learners for skills training that will prepare them for the workplace after matric. The implications of this change for the proposed research is that learners will learn knowledge and skills that will prepare them for gaining employment and sustainable livelihoods.

3.3.3 Selection of the research participants

Teachers and learners come to schools from a variety of socio-economic backgrounds. These differences bring a wealth of different views, stances and ideologies in their areas of interest and work. Participants that were interviewed created their own realities which are specific to

their current personal social circumstances. Selected teachers were highly trained, experienced professionals who been teaching these subjects from Grade 10 to 12. Some of the participants in the abovementioned sites were work colleagues. We have worked together at cluster level and collaborated in setting assessment tasks. I was able to introduce the research project with ease because of the use of the mother tongue isiXhosa among the participants. This eased any initial apprehension and made them trust me.

Initially, I had intended to select and interview nine teachers and nine past learners from each of the sites. However, after several attempts to secure interviews with past learners and the teachers, I was able to interview only five teachers from Site 1, six teachers from Site 2, nine school leavers from Site 2 and I did a focus group interview with five pupils from Site 1. Some teachers refused to be interviewed regardless of multiple explanations, permission letters, access letters and a copy of the certified proposal I provided them for the interviews. Past learners from the OR Tambo district emigrate to bigger cities like Cape Town, Rustenburg, Johannesburg in search of work or better post-matric learning opportunities. I made this discovery while searching for school leavers who matriculated from the two sites between 2015 to 2018. As a result, I resolved to interview learners who were then in Grade 12 for the 2020 academic year in one of the sites, namely Ikwezi Technical Skills Centre (Site 1) as a focus group.

3.3.4 Permission to conduct research

Firstly, I set an appointment with the principals of both sites with the intentions of introducing myself, the purpose of my research project to them and reasons I had chosen their schools as sites for research and to provide clarity on all ethical considerations (see Annexures A and B). After having been granted permission to proceed with the interviews (see Annexures C and D), I left a copy of my research proposal with all necessary details. Secondly, I set up another appointment with the district director for the same purpose (see Annexure E) and was granted permission to conduct my research (see Annexure F).

3.4 DATA GENERATION

The researcher's interest provides focus whereas the desired data comes from group interactions. It is important for the researcher to gather useful and usable data using a variety of methods that are suitable for the study. Patton (2002) supported this approach stating that there is inherent bias that often accompanies single method, single observer, single case study

and single-theory research studies. Three methods of data collection were used in this study; these are discussed below as well as their importance and relevance to the study.

3.4.1 Selection of documents

A record of an event or process produced by individuals or groups in different forms is defined by Cohen, Manion and Morrison (2011) as a document. The first phase of data generation consisted of document analysis of the following documents: extracts from learners' textbooks, teachers' guides, CAPS documents, Practical Assessment Tasks, journals, government publications, research reports, newspapers and magazines. Harvey (2012) stated that when analysing documents, a researcher uses documents as evidence in proving the occurrence of an event or how a particular phenomenon is addressed, and this develops into confirmation of fact. Some of these documents have helped to augment and confirm information from various sources. As Bowen (2009) has stated, the researcher interprets documents to give meaning, gain understanding and develop empirical knowledge. The use of documents has helped me to answer research questions one and two of the study. The focus was on getting topics, content, analyses and discussions that relate to the green economy in South Africa.

For the first phase of data generation, I needed to determine which documents to use. As the first step, I chose official documents namely CAPS documents, teachers' guides and learners' textbooks. These are prescribed in schools and were commissioned to deliver CAPS content. I looked at CAPS compliant learners' books for Grade 12 in the Mechanical Technology stream to see how they addressed the intentions of CAPS and possible outcomes as anticipated by CAPS general aims. They had to be authentic in the sense that they had to be accredited by the Department of Basic Education (DBE) with the DBE stamp of approval. Secondly, I looked at the time frames of their publication to search for relevant, current content. The next consideration was accessibility of these learners' books. These are DBE accredited books that are easily found in local booksellers by learners when they need personal copies or for replacement of lost ones, and by teachers and researchers. They are popular with most schools because of affordability and they are always in stock. Language used is simple, easy to understand and subject specific.

After acquiring these documents, I skimmed and scanned them to find out what they were about to develop an understanding of the meaning and significance of what was contained in the document. I trawled through these documents to identify emerging themes that address the green economy related content. Most of these CAPS documents have prescribed content on

work schedules though it is presented differently in various learners' textbooks and teachers' guides on each subject. Summaries of all the themes which relate to green economy content were made. This was necessary to address the first research question which is about exploring opportunities that exist in the OR Tambo district for school leavers to participate in the green economy.

3.4.2 Semi-structured interviews

I was mindful of the fact that a qualitative in-depth semi-structured interview is basically an interaction between the interviewer and the respondent. There is an interchange of views between two or more people on a topic of mutual interest, according to Cohen et al. (2011). In this interaction, the researcher has a general plan of inquiry in the form of an interview schedule (see Annexures I and J) but not an exclusive set of questions that should be asked in exact words and in a particular manner. This gives the researcher greater flexibility to probe further and it also gives the participants freedom to elaborate further on their views. Data for the study has been collected from these interviews with the purpose of understanding the meanings participants attach to their perceptions, meanings and definitions of situations and how reality is constructed in contexts that are not structured in advance by the researcher. The researcher used the seven-checklist approach proposed by Fontana and Frey (2000) for semi-structured interviews. The approach is as follows:

- (1) Accessing the setting;
- (2) Understanding the language and culture of respondents;
- (3) Deciding on how to present oneself;
- (4) Locating the participants;
- (5) Gaining trust;
- (6) Establishing rapport; and
- (7) Collecting data.

After this exercise, I used Kvale's (1996) seven stages for interviews in progress. These are:

- (1) Thematising: This is where concepts like technical education, green economy are explored;
- (2) Designing: This refers to laying out the interviewing process so that one can conduct the purpose of the study and all the requirements;

- (3) Interviewing: This is process of asking questions and probing deeply to surface new cues;
- (4) Transcribing: This refers to creating a text for the interviews;
- (5) Analysis: This is where the researcher determines meaning out of the gathered data in relation to the purpose of this study;
- (6) Verifying: This is where reliability of the data is checked; and
- (7) Reporting: What the researcher has learned becomes accessible to everyone who is interested, and it is made ready for publishing. (Kvale, 1996)

The second phase of data generation was the interviews. The fieldwork began with interviews in November 2018. I went to the principals of both schools where I presented myself, my study and requested their assistance in my study. Upon granting me permission to conduct interviews, I explained to them that my interview sessions were not going to interfere with tuition time or co-curricular sessions. The next step was to meet with the teachers of the nine subjects. Five participants were chosen from Site 1 and six participants from Site 2. It was fortunate that some of them were colleagues that I worked with. Most unfortunately, some teachers (especially colleagues from the Science departments on both sites) were not keen to afford me an opportunity for an interview.

Table 3.1. Teacher information

Teachers' code	Subject area/s	Training/qualification/s	Years experience
Mr V-1	Engineering Graphics & Design (EGD), Civil Technology	B.Ed. (FET) Technical Education	6 years
Mr H-2	EGD	B.Ed. (FET) Technical Education	5 years
Mr Mg-3	Mechanical Technology, EGD	BEd (FET) Technical Education	7 years
Mr Z-4	Mechanical Technology, EGD	B.Ed. (FET) Technical Education	7 years
Mr F-5	Mathematics, Physical Sciences	B.Ed. (FET) Natural Sciences	6 years
Mr K-6	English, IsiXhosa	B.Ed. (FET) Humanities	3 years
MsB-7	English, isiXhosa	B.Ed. (FET)	11 years

		Humanities	
MrsD-8	Physical Sciences, Mathematics	BSc (Hons) Maths & Chemistry	29 years
Mr Nom-9	Mathematics	BEd (FET) Natural Sciences	9 years
MrsM-10	IsiXhosa, Life Orientation	Senior Teachers' Diploma, B.A.	37 years
NG-11	Life Orientation	BEd (FET) Economic & Management	9 years
Mr Mar-12	Physical Sciences, Mathematics	BEd (FET) Natural Sciences	4 years

Some colleagues agreed to the interviews after I had explained to them what my research was about and had outlined all the ethical considerations and voluntary informed consent concerns (see Annexure G). Learners were chosen purposively from these two sites. They were chosen based on being post matric school leavers, pursuing further studies at university and college; others were either self-employed or at home. I also explained to them what the research was about, ethical considerations, usefulness of their contributions, voluntary participation and the anticipated impact that this study might have for further research (see annexure H). The content of the data received during the interviews dealt with the understanding, background knowledge, impressions and selected perceptions of the respondents interviewed. These interviews were used to produce data for the investigation. The responses were sufficient to answer the research questions of the study.

The teachers who were sampled specialise in different subjects and had different world views and different levels of exposure to green economy content, inside and outside of their working space and fields of study. Diverse as they were, I was also mindful of the fact that there would be convergences and commonalities and possible patterns with these colleagues and peers which would strengthen the data generated. No hard-and-fast selection criteria on gender, experience or qualifications were used. Teachers were selected based on the subjects that they teach in the Mechanical Technology stream. The researcher didn't only ensure that he understood the participants' views but also assisted them to explore their own beliefs. Through these interviews the researcher was able to probe deeper into the responses of the participants on the causes and impact of poverty, their views and beliefs on the role of technical education as well as green economy in the Eastern Cape. Interviews have also been helpful because discussions on poverty and technical education are highly confidential and sensitive especially

when participants are currently practising teachers. They are usually reluctant to openly discuss such matters.

Interviews are helpful because they occur in confidential, one-on-one situations where confidentiality and anonymity are guaranteed (Kvale, 1996). The research questions focussed on participants' experiences, inside and outside of the classroom and how they gained that experience. During interaction with the participants, an insightful understanding was gained as this revealed the perspectives of the interviewees. This was made possible because the researcher was able to ask "how", "what" and "why" questions to understand the nature and complexity of the processes taking place, in this case curriculum practices.

Today's increasing use of technology has enabled the use of audio recording using cell phones as aids during the interview process. Audio recordings are helpful because they supply a more complete and correct record of data. Secondly, they were useful in data validity assessment. Recordings could be stopped and started when the researcher wanted to code or categorise the data. Before the recordings were done, permission from the participants was obtained. The researcher explained the need for recording as this ensured accuracy and to prevent misquoting the responses of the participants.

After recording the data through cell phones, the next process was to transcribe the recordings for analysis. In addition to cell phone recording, I also used note taking as another data collection instrument. Note taking is particularly useful because it helps the interviewer to formulate new questions as the interview progresses especially where the researcher wishes the participant to repeat earlier claims. While taking notes, the interviewer can ensure that the interview steers towards the intended direction. Notes are a good back-up in case the cell phone gets stolen or malfunctions or recordings get erased during transcription. These notes were helpful at most times in pacing the interview as well as in paying attention and detail on what was noteworthy in the participants' responses.

3.4.3 Focus group interviewing

This kind of research relies on the interaction, reflections and engagements amongst the participants and the researcher based on the topic that is supplied by the researcher. The researcher invites the participants to the discussion and stresses the role of the researcher, the purpose of the study and what it seeks to achieve. "Such interviews are useful ... where a group of people have been working together for some time or common purpose or where it is seen as important that everyone concerned is aware of what others in the group are saying" (Watts &

Ebbutt (1987) as cited in Cohen, Manion and Morrison, 2011, p. 432). In this case, as a researcher, I presented an interview schedule to five current matriculants (see annexure J). After having struggled to find learners who matriculated between 2015 to 2018 in one of the research sites, namely Ikwezi Technical Skills Centre, I decided to include focus group interviewing as the third method.

I used this method to expand my knowledge on learners' perceptions about the green economy. This method enabled me to gather data quickly from these learners as I had a condensed structure that made it easy for me to ask for substantial opinions from the participants. Even though this group of learners was not representative of the entire targeted learners, it helped me to engage in open discussions with the learners and their reflections about the green economy in their technical education studies. I was able to generate a wider range of responses from the learners. Answers built on each other's and these participants complemented each other with more points. This enabled participants to give answers that they would not have thought about by themselves, so this reflected the views of this group and not the individual members.

3.4.4 Summary of data generation methods

In order to further explore the results found through document analyses and to answer research question two and question three, the researcher conducted interviews. This was done to facilitate and record conversations with the participants. It is through these conversations that the researcher receives the participants' construction of reality in their own terms rather than imposing the researcher's preconceived notions of reality. In semi-structured interviews, Patton (2002) concluded that the researcher asks open ended questions and probes that yield in-depth responses about people's experiences, perceptions, opinions, feelings and knowledge. Data consists of verbatim quotations with sufficient context to be interpretable (see annexures K and L). With the group interview, the important factor is the view of the group rather than individual opinions. There are diverse views and understanding that I could solicit from the participants. It also enabled me to hold conversations with these learners, get instant feedback and engage them further on particular matters to gain even deeper insights.

Table 3.2: Inventory of data generated

Data type	Source	Purpose of data	Data labels	Annexure
Teacher interviews	12 teachers	Teachers' reflection on green economy	MrV-1; MrH-2; MrMg-3; MrZ-4; MrF-5; MrK-6; MsB-7; MrsD-8;	Annexure K

		knowledge and how it is taught and assessed Content	MrNom-9; MrsM-10; NG-11; MrMar-12	
CAPS documents	Extracts with green economy content	To identify green economy in these subjects and how this content is expected to be taught and assessed in these subjects	CX-1, CE-2, CMAT-3, CTM-4, CSC-5, CTSC-6, CLO-7, CEGD-8, CMT-9	
Past learners semi-structured interviews	9 past learners from Site 2	Learners reflections on their knowledge of green economy content	AT1, PN2, TN3, Maz4, SG5, ZV6, MissM7, MzT8, YD9	Annexure L
Group interviewing	5 learners from Site 1	Learners reflections on their knowledge of green economy content		Annexure O
Textbook extracts	Extracts with green economy related content	To identify gaps needed so that teachers can be capacitated in their classrooms when dealing with green economy	ENGFA, MATH, TMAT, TSC, LO, EGD, MT	Annexure P

3.5 DATA ANALYSIS AND INTERPRETATION

This section describes how data was treated, interpreted and analysed. Firstly, the researcher had to sift through the raw data to separate what was significant from what was irrelevant and not important. After this sifting and reduction, the researcher had to identify important categories, patterns and themes. This study is framed by the theory of practice architectures. The collected data has been analysed and interpreted based on this theory. This was done to aid in drawing conclusions that reflect the ideas, concepts, interests and questions that initiated the study.

3.6 ETHICAL CONSIDERATIONS

This section serves to summarise the role of ethics in research, clarify the orientation to research ethics taken in this study, and to describe (and where possible to provide evidence of) research conduct in line with that ethical orientation.

3.6.1 An ethical approach to educational research

Certain issues tend to arise when research has to do with humans and animals. These issues include publishing findings in a transparent way, not plagiarising other people's work and not falsifying work (Resnick, 2015). According to the British Educational Research Association (BERA) in Ramrathan, Le Grange and Shava (2017), the researcher needs to ensure that participants understand the process that they engage in, why their participation is required, who will use the research findings and how they will be reported. Research ethics play an important role in research for various reasons. They promote the aims of research which is knowledge expansion. They support values required for collaborative work such as mutual respect and fairness. They ensure that the readers of research can trust the end-product due to its credibility (Resnick, 2015).

3.6.2 Aspects of ethical conduct in this case study

In any form of research, respecting one's individual rights and exercising good conduct are of paramount importance. As a researcher, I ensured openness and transparency of my intentions with the participants. I ensured that my research data meticulously represented the participants' responses to enhance its trustworthiness and reliability. Permission to conduct the interviews was requested and granted from the University's ethical standards committee (see Annexure M), school principals as well as District Director. The research proposal was sent to the District Director as means of supplying an elaborate and authentic purpose of this study. However, the researcher regularly reiterated confidentiality and voluntary participation. All the participants were given consent letters as a means of informing them of the purposes and intentions of this study. The names of the sites where research was done was not kept anonymous because I wanted to maintain authenticity in my study and this study presents little to no risk to participants. All the gathered data was used for solely academic purposes. The researcher adhered to the values of respect, honesty, confidentiality, legality as well as non-disclosure of the participants.

3.6.3 Voluntary informed consent to participate

Conducting research can be intrusive into an individual's life and workspace. I was mindful of this and explained to the participants that their participation was voluntary and could be withdrawn at any time. Some of the participants in the abovementioned sites are work colleagues. We have worked together at cluster level and collaborated in setting assessment tasks. I was able to introduce the research project with ease because of the use of the mother tongue isiXhosa among the participants. This eased any initial apprehension.

I informed my chosen participants about my research. I fully disclosed to them the procedures and the possible risks involved in research and requested their consent to participate. I told them that volunteering meant they were at liberty to withdraw after initially agreeing to participate in the research. I ensured that all participants had full information, including why and how they were chosen to participate in this research. This began by explaining to the participants the study's purpose, my university affiliation and consideration of expectations and any risks associated with the study. This information was provided and documented in English and verbally discussed in isiXhosa where necessary. Participants' consent was freely given. Those who raised concerns about their identities being disclosed in this study were assured of confidentiality and anonymity.

3.6.4 Anonymity and confidentiality

Although the names of the schools are used in this report, research participants' names are not used. Information that is provided by the participants should not reveal their identity. In their discussion on anonymity, Cohen et al. (2011) explain how non-traceability can be an important matter in face-to-face interviews and that, if relevant, this extends to aggregating data so that an individual's response is unknowable (p. 91). Data labels instead of names were used in the analytical memos and data inventory for each of the participants. True identities remain known to the researcher.

3.7 REFLECTIONS OF DATA GENERATION

The first challenge in data generation for this research involved convincing colleagues to agree to be interviewed. I made many appointments, but some refused or were disinterested while others were unavailable during the scheduled times that we agreed upon. The second challenge was the inaccessibility of learners from Site 1 for interviews. As I mentioned earlier, the targeted group of past learners are in different parts of the country. Several attempts were made to locate them, but some had changed their cell phone numbers or had relocated and changed addresses. The third challenge was clarity of the cell phone recordings particularly with the school leavers from Site 2. Because of distance and quality of handsets used, fuzzy, background noises could be heard as some held their phones quite close. This background noise couldn't be eliminated and presented audibility challenges during the tedious, transcribing process.

Participants were encouraged to use languages of their choice and most resorted to using isiXhosa. This process presented translation challenges. This is because some concepts like green economy, renewable energy do not exist in the vernacular. Some participants would enthusiastically veer off the topic and it was quite challenging to realign them with the interview questions. I had to elaborate extensively to the participants about what the concepts meant so that we were at the same level of understanding. In general, however, the participants showed interest in the research as it seemed to be new in their fields of study.

CHAPTER 4

FINDINGS

4.1. INTRODUCTION AND OVERVIEW OF THIS CHAPTER

This study sought to investigate the ways in which curriculum practices in the Grade 12 Mechanical Technology subject stream prepare learners for the green economy. This chapter presents the data from selected documents, teachers' interviews and learners' focus group discussion from Site 1, namely Ikwezi Technical Skills Centre, as well as interviews with teachers and past learners conducted in Site 2, namely Umtata Technical College.

The first section of this chapter draws on document analysis to provide an overview of the green economy opportunities in the OR Tambo District for school leavers in the energy, agricultural and water management sectors. These sectors were identified as most relevant due to the district's rural nature, agricultural opportunities and challenges with provisioning of water in the context of drought and climate change (see Sections 4.2.2; 4.2.3; 4.2.4). This discussion is followed by an overview of the green economy foci in the Grade 12 Mechanical Technology curricula (Section 4.3.1) and green economy content identified in Mechanical Technology textbooks (Section 4.3.2). The chapter concludes with a description of current curriculum practices related to green economy in the Mechanical Technology stream in Sites 1 and 2, mostly derived from interview data with teachers and past learners (Section 4.3.3.)

4.2 GREEN ECONOMY OPPORTUNITIES FOR SCHOOL LEAVERS IN EASTERN CAPE AND OR TAMBO DISTRICT

4.2.1 Section overview

In response to socio-economic and political challenges faced by the Eastern Cape, interventionary programmes and projects have been introduced as means to curb economic hardships that are out of control in certain regions of the Eastern Cape. In the following sections, I discuss these interventions in different sectors. Although these projects are not based in the OR Tambo District, they are potentially beneficial to all district municipalities because skilled and semi-skilled workers are drawn from all the municipalities in the province. It should be noted that this overview of green economy opportunities is not comprehensive but illustrative of typical green economy initiatives in the region.

4.2.2 Energy sector

Renewable energy includes solar, wind, biofuels, hydropower and potential jobs through processing raw materials, manufacturing technologies and plant construction (Edkins, Marquard & Winkler, 2010) and can offer solutions to ensuring growth and decarbonising economics across the globe (IRENA, 2016). Renewable energy has economic benefits that make it an attractive alternative to fossil fuel energy resources. These benefits include job creation, enterprise development, local procurement of labour capital and socio-economic development (Eberhard & Naude, 2017). As these renewable energy projects are often located in the rural areas, they potentially play a key role in creating jobs and improving the well-being of society, especially rural communities. High levels of renewable energy consumption may create job opportunities through installation of devices, routine maintenance and upgrading of energy generating instruments by artisans and qualified professionals. Unlocking South Africa's potential to produce solar, hydro and wind energy, as well as biofuels, could aid in alleviating high unemployment rates (Khobai, Kolisi, Moyo, Anyikwa, & Dungela, 2017).

The Eastern Cape is emerging as a major source of electricity in South Africa with the biggest number of wind projects situated in the province (Daniel, 2020). Geographically, the province has mighty wind flows along its coasts together with a strong and steady wind current between Cookhouse and the Western border of Lesotho. These windy areas are close to the grid connection and this makes it easy to feed into South Africa's electricity supply (Daniel, 2020).

In a study on the green skills in South Africa's economy, the International Labour Organisation (ILO, 2010) noted that new skills and retraining for the greening sector should filter successfully through the demand and supply process. These green skills that are being developed are important contributions to alleviating socio-economic challenges of the continent.

Some of the district municipalities in the Eastern Cape, like Amathole and Joe Gqabi municipalities, are Designated Water Services Authorities (WSA) for the province's local municipalities. This means that these municipalities often regulate water services, management of waste and water treatment plants. At present the Eastern Cape has the largest wind farm in South Africa, known as Cookhouse Wind farm which provides alternative wind energy to the Eskom power grid in the province. This Wind farm contributes approximately 130 megawatts of wind power to Eskom network. Other wind farms include:

- Nxuba Wind Farm which is an independent power producer located between Molteno and Sterkstroom. It generates 100MW of clean and renewable energy that is fed into Eskom's grid;
- Kouga Wind Farm is situated approximately 70kms southwest of Port Elizabeth, between Oyster Bay and St Francis Bay. It delivers 80MW.
- Metrowind's Van Stadens Wind Farm (Daniel, 2020).

There are other wind farms close to completion, namely Amakhala Emoyeni and Jeffreys Bay that will contribute approximately 200 MW to the provincial power grid, leading to significant green jobs creation (REIPPP, 2015). In addition, within the province, there is the Energy and Water Sector Authority and Training Authority (EWSETA) which is a public entity established in terms of the Skills Development Act, 1998 (Act 97 of 1998) with a mandate to facilitate skills development within the energy, renewable energy, gas and water service sector of the economy as determined by the Minister of Higher Education and Training. All these programmes seek to encourage municipalities to strive for continuous improvement of services towards its citizens, compliance with legislation and job creation whilst protecting the environment.

There are projects that seek to introduce hybrid energy systems which will combine wind, micro-hydro, photovoltaic and storage batteries to provide off-grid supply (Khobai et al., 2017). For example, there are currently two pilot hybrid systems in the Eastern Cape: at Hluleka Nature Reserve on the Wild Coast and Lucingweni, both of which are within the OR Tambo District Municipality. The Hluleka hybrid mini-grid system consists of two proven 2,5 KW wind generators and three Shell Solar photovoltaic (PV) module arrays fitted with 56 100-Wall modules. Lucingweni hybrid system has 50KW solar PV panels and 36KW wind generators (Khobai et al., 2017).

The South African Cabinet approved the National Biofuels Industry Strategy in 2007 with the aim of addressing poverty and economic development. It was estimated that this would be achieved through a 2% biofuels addition to the current fuel pool and that this would contribute towards creating approximately 25,000 jobs in rural communities (Khobai et al., 2017). An ethanol project was established in Cradock in 2014 and it was structured to consist of two components: the processing plant and the agricultural component. The site set aside for this bioethanol processing plant was 550 hectares with construction costs estimated at R1,1 billion. It was projected to produce almost 90 million litres of bioethanol a year as a contribution to the

Department of Energy's target of 2% injection of biofuels in the national liquid fuels supply. This project has been split into two phases: the first phase will import approximately 22, 500 tonnes of grain sorghum from farmers around the country. The second phase will use 7,500 tonnes of grain sorghum from emerging farmers. After production, fuel will be exported from Cradock via rail to different parts of the country.

Under the agricultural component, the Department of Rural Development and Land Reform has acquired 25 farms from commercial farmers worth R346 million and given them to emerging black farmers (Nasterlack, 2013). These farms consist of irrigated land, grazing areas and infrastructure. These farms are state-owned; farmers have lease contracts with the government. Sugar beet will be the main feedstock for ethanol production while sorghum will be grown in Cradock and purchased from the farmers as supplementary feedstock (Jebe, 2018). This project has been estimated to create more than 1,000 jobs. Most of the day-to-day operations of the plant have, however, been projected to be skilled jobs outsourced from various parts of the country (Jebe, 2018).

4.2.3 Agriculture and land management sector

Agriculture is a core sector for food security since it provides not only food to different households but raw materials, employment, foreign exchange and other essential resources for economic development (Adekunle, 2013). As means of consistent food supply, some families have home gardens which are considered to be a community's most adaptable and accessible land resource, important for reducing vulnerability through poverty and ensuring food security (Adekunle, 2013). These home gardens are important because they can provide income and sustenance throughout the year for rural families through commercialisation. Self-employed family members are able to sell their crops in local markets at prices determined by them. Also, they are able to save on spending by using some crops for homestead consumption. These food gardens increase production, improve household health and nutrition but also generate income (Adekunle, 2013).

Local forests are developed by the communities into local resource management systems that supply the community with timber and non-timber forest products. Labour capital that is outsourced to work in these timber factories is recruited from these rural, local communities (Obiri, Lawes & Mukokwe, 2002). Families engage in wage work and natural resource use. One member in a family will have a job and another contributes to the family by planting vegetables, collecting sea resources or even herding cattle (Hajdu, 2005).

4.2.4 Water management sector

South Africa, across its various district municipalities, has limited available water because annually the country experiences an average rainfall of approximately 464mm. This classifies South Africa as a semi-arid country (Dennis, 2012). Climate changes in South Africa have resulted in changing rainfall patterns. There have been weather pattern variations ranging from intense storms to extreme droughts and floods, increased evaporation, changes in soil moisture and degeneration in water quality and decrease in water availability (Department of Water & Sanitation [DWS], 2013). All these have increased the demand for water usage and unfortunately they have also escalated the risk of widespread water shortages especially in rural communities like the OR Tambo district. This is because these areas do not have an effective water resource management plan and there is lack of systematic drought risk management planning according to Water Research Commission (2015).

A further challenge is that of non-revenue water, which is defined as water that is produced and enters the distribution system but is never billed to customers because it is lost due to leakages or illegal connections (Tortajada, 2008). This practice is very common in the urban centres of the OR Tambo district municipality. This could be attributed to skills deficits with the water sector or simply put, the lack of skilled technicians to fix such leakages, insufficient resources, lack of funds to restore burst water supplies and many other factors. Although people are aware of proper water management practice, non-revenue water represents excessive water loss in these municipalities. These losses of water in the form of leakages from distribution systems and overflows at the utility reservoirs can be caused by poor operations and maintenance, lack of active leakage control and poor quality of underground water supply (Van den Berg, 2015). Other serious challenges experienced in the water sector according to Mehta et al. (2014) include:

- An erosion of the skills of the Department of Water Affairs and Sanitation which has been held captive by consulting agencies that have monopolised critical skills necessary to executive routine water management tasks;
- Dysfunctional infrastructure;
- Water governance issues in local municipalities;
- Flood and drought risks;
- Deterioration of water resource quality and ecosystems due to pollution;

- Developmental infrastructural projects impact on the water habitats;
- Skills shortage and limited institutional capacity; and
- Inadequate integrated water investment framework. (Mehta et al., 2014)

This indicates that there is room for improvement in water resource management in these local municipalities. Hiring of skilled personnel who have been adequately trained to attend to these challenges would be a starting point. This includes hiring past learners who have received training in services like plumbing to deal with these water-related challenges effectively. This section has briefly outlined some key skills challenges in the agricultural, energy and water management sectors in the Eastern Cape to illustrate the range of potential employment opportunities for learners matriculating from the Mechanical Technology stream. Although the examples are not comprehensive, they suggest that green opportunities do exist but are not well-established as popular or well understood career options for school leavers.

4.3 SAYINGS, DOINGS AND RELATINGS REGARDING GREEN ECONOMY IN THE GRADE 12 MECHANICAL TECHNOLOGY STREAM'S CURRICULUM PRACTICES

4.3.1 Section overview

This section highlights how the South African curriculum intends to furnish learners with knowledge and skills they can use in everyday life contexts. This is done so that these skills and knowledge will trigger new ideas and prepare learners to become product creators. Practitioners, who are teachers in this context, make every practice possible through (i) how they express themselves in their teaching and learning activities through language (sayings); (ii) how their actions are constrained or enabled within an environment (doings); and (iii) how practitioners interact with one another (relatings). Before presenting a subject-based summary of the sayings, doings and relatings pertaining to green economy in the Mechanical Technology stream, I summarise the overall purpose and the guiding principles of the National Curriculum, and the desired competencies that learners should demonstrate by the end of their schooling.

4.3.2. National Curriculum Statements Aims and Principles

The National Curriculum Statement (NCS) Grades R-12 is based on the following principles that include:

- Active and critical learning: This refers to instances where teachers exercise an active and critical approach to learning, rather than rote and uncritical learning of given truths. This would enable learners to apply their acquired knowledge and make informed decisions.
- High knowledge and high skills: The minimum standards of knowledge and skills to be achieved at each grade are specified and set high, achievable standards in all subjects.
- Progression: Content and context of each grade shows progression from simple to complex.
- Human rights, inclusivity, environmental and social justice: infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. The National Curriculum Statement (NCS) Grades R-12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors. Learners need to have an understanding of the ways in which humans have impacted negatively on the environment and the organisms living in it so that they can reverse the damage that has been done, be cautious of their actions and strive to protect the environment from harm at all costs.
- Valuing indigenous knowledge systems: Acknowledging the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution.
- Credibility, quality and efficiency: Providing an education that is comparable in quality, breadth and depth to those of other countries. (South Africa, Department of Basic Education [DBE], 2011).

Furthermore, the critical cross field outcomes provide further guidance as to what competencies learners are expected to have when they leave school. Of the seven competencies, I identify two as being of direct relevance to the potential of the Mechanical Technology stream to give school leavers access to green economy opportunities. These are:

- Use science and technology effectively and critically showing responsibility towards the environment and the health of others, and

- Demonstrate an understanding of the world as a set of related systems by recognizing that problem-solving contexts do not exist in isolation. (DBE, 2011, p.6).

Implied in these desired competencies is the fact that the education learners attain by the end of their twelve years of schooling should equip them with skills and knowledge to be able to address social issues such as unemployment, poverty, health, nutrition, safety and security. In the OR Tambo District, these socio-economic challenges are often interlinked with ecological and environmental management challenges. Certain subjects that are taught within the Mechanical Technology stream play a very significant role in developing the learners' thinking and problem-solving ability. This becomes useful in the learners' lives especially after Grade 12 when they are faced with real-life situations that require them to use their thinking and decision-making abilities.

The following sections (4.3.3.-4.3.10) synthesise the interview and document data to describe the sayings, doings and relatings in each subject. Below are eight of the nine subjects that are learnt within the Mechanical Technology stream. One of the subjects offered in this stream, namely isiXhosa Home Language, has been left out. Environmental content in the subject was missing in all of its documents, starting from the CAPS document to learners' textbooks. The descriptions aim to show if and how the green economy is presented in the sampled curriculum documents and textbooks and then reflected upon by the teachers and past learners at the two case study sites.

4.3.3 Green economy in Engineering, Graphics and Design (EGD)

4.3.3.1 Sayings regarding green economy in EGD

Engineering Graphics and Design (EGD) forms the core of technical education at high school because it incorporates all the trades (civil, electrical, mechanical technology) into one subject. According to its environmental content (see Annexure Q), today's designer must make a conscious effort to reduce the overall impact that every product has on the environment and endeavour to find solutions to needs that require lower power consumption and greater energy efficiency (Annexure Q). If designers could keep this in mind with new products at the design phase, then they could go a long way in promoting environmental stability. This would require taking the whole life cycle of a new product into consideration. This means they need to consider using materials that are recyclable and biodegradable (Annexure Q). Should this not be possible then they must consider the ecological effects that could result from using materials that are produced through processes using hazardous chemicals and emissions. New products must be designed with a longer lifespan and the disposal of the product in mind; once a product

has become obsolete, it must be safe to the environment (Annexure Q). It is crucial to note that the content of EGD has not warranted the inclusion of green economy content into the CAPS document. There is no guidance or inspiration offered regarding green economy opportunities.

4.3.3.2 Teachers' green economy content awareness in EGD

Teachers have different ways of understanding and interpreting this environmental content in EGD curriculum. MrV-1 does not remember a chapter that deals with green economy: “Not really. I don’t remember having a chapter that deals with such but what I remember but am not sure if it will relevant is that since we ‘communicate’ through drawing, that will be something like a space here at school where we burn waste” (see Annexure K, Q4, MrV-1). Maybe a learner could have an idea of designing something that will useful to the school from that trash. So, the EGD learners will be able to scribe down this idea that other learners have. They could collectively plan on how they could design something that will enable material recycling. MrH-2 assumed green economy is where one talks about agriculture, seeds, plants and the soil. “Uhhm, green economy, uhhm am subject to correction. When you are talking about green economy I think you are talking about like in agriculture when you plant, it’s all about seeds and plants or it’s all about plants green economy where you use the soil. Yes, I think it’s something that has to do with soil and when you plant something and ...” (see Annexure K: Q4; MrH-2).

4.3.3.3 Doings regarding green economy in EGD

Mr V-1 expressed that tasks are done in the workshops for PAT (Practical Assessment Tasks) Criteria. There are marks allocated for good housekeeping. After PAT or other design tasks students have finished and need to tidy up and consider the safety of those that will follow after their lessons. Some parts are burnt whilst other are stored away after PAT or are recycled and sold so that they can earn some income. MrH-2 indicated that, when learners design these projects, they design and also sell them because when you design it is like you ‘come up’ with your own idea, so you sell that idea to the person or company that will assemble that project (see Annexure K, Q5 ; MrH-2)

4.3.4 Green Economy in Mechanical Technology

4.3.4.1 Sayings regarding green economy in Mechanical Technology

As it is prescribed in CAPS, Mechanical Technology focuses on concepts and principles in the mechanical (motor, mining, shipping, rail, power generation and others) environment and in technological processes. It embraces practical skills and the application of scientific principles. This subject aims to create and improve the engineering and manufacturing environment to

enhance the quality of life both of the individual and society alike, and ensure the sustainable use of the natural environment and resources (South Africa.DBE, 2011).

MrMg-3 conveyed that he did not know much about green economy but that he understands when it comes to the green economy there is a part of recycling within it. “Under the green economy I do not know much about it but the only thing that I understand when it comes to the green economy is that there is a part of recycling within it ... I understand that part when it comes to the green economy.” (Annexure K, Q4; MrMg-3) These metals are recyclable. So, the waste material that the learner has used, she can still use it for recycling since metals are recyclable. MrZ-4 stated that there is a section in his subject that covers green economy. For an example in the workshop, as they work with cars, there are pieces that remain which they call off-cuts. These pieces are kept under restricted zones in the workshops and eventually are sold off for recycling. There is also a chapter which is called safety where there is plenty of emphasis on the safety of employees, employer as well as the environment (annexure K, Q4; MrZ-4).

4.3.4.2 Doings regarding green economy in Mechanical Technology

MrMg-3 said that in a workshop there are rules and regulations of a workshop and the learners understand those rules. They know that one cannot play in the workshop, tools have to be returned to their right storage areas. This is a major rule of housekeeping. Also, there is a container that is used to store waste material in a well ventilated workshop. The workshop must be well ventilated because dangerous fumes are emitted during PAT in the workshops. Someone may be cutting metals using the grinder while others may be welding or someone may drill with the drilling machine. Ventilation is important. One must work in a good space and be taught to keep one's environment clean always. Ten minutes prior to the end of the lesson or task they need to tidy up before they leave (housekeeping). Tools are re-assembled and put in their correct storage areas and they need to tidy up and clean the workshop before they leave. The cut-offs are collected and put into a safe storage box, out of reach of learners. When there are plenty, they are taken to a recycling plant like Dizz who buys these cut-offs. The school benefits from this. MrZ-4 pointed out that there is a chapter where they use a tester during practicals. This is called a gas analyser tester analyses the gases in a car after having fixed the car. The car will be test-driven in a short distance. The purpose is to check whether it is a complete mixture that is environmentally friendly so that it doesn't adversely affect the environment. So there is a need to check if it the mixture of the petrol, is it burning completely or half burning in different cylinders so it doesn't affect another mixture which is there is an

oil or someone may find that oil is mixing with petrol that is going to affect the community (See Annexure K, Q5; MrZ-4 & Mr Mg-3.)

4.3.5 Green Economy in Technical Mathematics

4.3.5.1 Sayings regarding green economy in Technical Mathematics

MrF-5 pointed out that he last heard about green economy at high school and hadn't heard about it since as it had been omitted in their university training. "Back at high school I heard about it in Life Sciences but honestly speaking in recent years I have not heard about it..." (see Annexure K, Q4; MrF-5).

4.3.5.2 Doings regarding green economy in Technical Mathematics

MrF-5 asserted that they do not have experiments in Technical Mathematics but have investigations and assignments and these do not really address green economy related content.

4.3.6 Green Economy in English First Additional Language (FAL)

4.3.6.1 Sayings regarding green economy in English (FAL)

English as the first additional language is meant to enable learners to acquire language skills necessary to communicate accurately taking into account audience, purpose and context. The learners should be able to express and justify orally and in writing their own ideas, views and emotions confidently in order to become independent and analytical thinkers (South Africa. DBE, 2011). This subject focusses on the learner's communicative competence. This means that it develops the learner's ability to properly construct well-formed sentences (syntax) ; study how to properly pronounce words, meaning of words (semantics) as well as social knowledge on how and when to appropriately use terms and phrases. This involves oral work, creative writing, language, grammar and literature.

In addition, MrK-6 told me about a recycling business near his house called Umtata Waste whereby people collect recyclable material there so that is how he would say makes him more knowledgeable about the green economy. "Yes I am quite exposed it... (MM:...OK... would you mind to explain further what is it that you know about it?) I know that in my street as I live in town there is a business called Umtata Waste whereby people collect recyclable material there so that is how I would say I am more knowledgeable about the green economy.(MM: Can you tell me more about what is it that they do in this company?). People collect plastics, bottles, cardboards and they take them to that company and sell them there ... they clean the streets. So they leave the streets clean and the environment clean ... they are also making profit out of it" (see Annexure K, Q4; MrK-6). Collection of litter results in income generation for the poor. However, litter collection results in the cleanliness of the environment. This information

assists MrK-6 in his class discussion on environmental awareness issues. He is able to incorporate his knowledge with the ideas that come out of reading comprehension passages on green economy and other related tasks.

MsB-7 showed insight into green economy saying she understood it to be whereby people talk about waste management, water harvesting, water pollution and recycling.

4.3.6.2 Doings regarding green economy in English FAL

Even though English First Additional Language does not have specific chapters that deal exclusively with green economy content, there are prescribed tasks that raise awareness in the learners about this. Below are some of the activities that learners do in class, as prescribed, to enhance their awareness about environmental management so that their actions change and encourage them to be responsible citizens and take good care of the environment for future generations. These tasks are structured as follows and have been extracted from subject documents (see Annexure R):

Activity 1 (i) Interview people about their energy use and write a report about your findings. Learners must conduct some research in their community and present their findings orally and then write up their findings in a report. (Annexure R)

Activity 2 (ii) Report presentation to the class. Learners must present to the class (oral work) about an investigation they did about energy use in their respective communities. They learn about energy savings tips; dangers associated with energy devices and how protect themselves from harm resulting from multiple energy sources.

Activity 3: Reading and viewing: Read an interview with an environmental activist. The learners expand their knowledge about nature preservation, waste management, climate change, biodiversity care and support and many others.

Activity 4: Read an article entitled: South Africa – where climate change may trigger a toxic time bomb.

Activity 5: Visual literacy: Population with access to clean water around the world.

Activity 6: Summary writing: Teens care about the earth.

Activity 7(a): Write a letter to the press about a community service programme: An environmental, farming, cleaning project. (Annexure R)

Chapter 2 – This chapter is about teaching learners about environmental challenges in South Africa today and what we can do to respond to them.

Topic: Caring for the environment

Activity 7(b): Summary and visual literacy. Title of the summary: Emily Tjale, organic farmer.

Activity 8: Graph reading: Energy use in South African homes

Activity 9: Revise analysing an advertisement: Recycling glass (Annexure R)

MrK-6 pointed out that, for languages, learners are given tasks like prepared speech or writing summaries. As the learners read an extract or article or comprehension passage with green economy content, they will learn more about green economy. Someone is able to participate in the green economy through collecting papers, plastics, metals and selling them. This helps financially and also benefits the environment. Learners have to write essays discussing their understanding of the green economy. They could be given a topic that has to do with making a living out of collecting papers, then the learners will be able to come up with their own ideas, their own ways of making a living out of the green economy in their essays. The second teacher, MsB-7, noted that green economy content is also shared and discussed when the learners engage in debates.

4.3.7 Green Economy in Physical Sciences

4.3.7.1 Sayings regarding green economy in Physical Sciences

Physical Sciences deals with society's needs to understand how the physical environment works in order to benefit from it and responsibly care for it (South Africa. DBE, 2011). Its aim is to promote: knowledge and skills in scientific enquiry and problem solving; the construction and application of scientific and technological knowledge; an understanding of the nature of science and its relationships to technology, society and the environment. Ultimately, the subject prepares learners for future learning, specialist learning, employment, citizenship, holistic development, socio-economic development and environmental management (South Africa. DBE, 2011).

One of the teachers, MrsD-8 had heard about green economy but not in the CAPS document.

“We have heard about that but I don't think the learners are aware of that ...(MM:... but you as a teacher can you elaborate as to where have you learnt about it? Maybe you might have heard or read about it somewhere or probably in the CAPS document on the green economy?) ... no not in the CAPS document ... I just heard about it ... (MM:

It's not a prescribed topic for Physical Sciences) ... no ... although the Science Expo nowadays encourages that but even this time in the science expo we didn't see much of that ... they always talk about water purification and solar energy and all but not much ... (MM:... so it is more of extra tasks rather than being part of the main curriculum)... yes its not part of the main curriculum.” (see Annexure K, Q4; MrsD-8).

In as much as it is not prescribed in Physical Sciences, there are other extra-curricular projects like the Science Expo that encourage learners to take care of the environment. Exhibitions like Science Expo encourage learners to design projects that address or campaign for water purification and solar energy as a means to increase their environmental awareness. The second teacher, MrMar-12 believed even though it not prescribed in the Grade 12 Physical Science syllabus, the green economy helps to reduce pollution, creates job opportunities for unemployed people because teachers talk about recycling, water harvesting and other activities.

4.3.7.2 Doings regarding green economy in Physical Sciences

MrsD-8 noted that even if it is not in the prescribed Grade 12 syllabus, for learners' interest, she told them that wasted steel is exported to countries like India as there are no steel recycling plants in South Africa. There they recycle it and return it again to South Africa. MrMar-12 noted that learners sometimes use devices like AC-DC generators in the laboratories for experiments in electricity generation. These generators are operated in the lab by the learners and they generate energy using wind, water and the sun.

4.3.8 Green Economy in Mathematics

4.3.8.1 Sayings regarding green economy in Mathematics

Mathematics is a human activity that involves observing, representing and investigating patterns and qualitative relationships in physical and social phenomena and mathematical objects (South Africa. Department of Basic Education [DBE], 2011). This subject helps the learners to develop mental processes that enhance logical and critical thinking, accuracy and problem solving (South Africa. DBE, 2011). However, the subject content does not have green economy content (see Annexure K, Q5; MrNom-9). MrNom-9 had not been trained in green economy content or even environmental content.

4.3.8.2 Doings regarding green economy in Mathematics

MrNom-9 indicated that Mathematics does not have these.

4.3.9 Green Economy in Life Orientation

4.3.9.1 Sayings regarding green economy in Life Orientation

Life Orientation is the study of the self in relation to others and to society. It addresses skills, knowledge and values about the self, the environment, responsible citizenship, a healthy and productive life, social engagement, recreation and physical activity, careers and career choices. (South Africa. DBE, 2011). These include opportunities to engage in the development and practice of a variety of life skills to solve problems, to make informed decisions and choices and to take appropriate actions to live meaningfully and successfully in a rapidly changing society. It not only focuses on knowledge but also emphasises the importance of the application of skills and values in real-life situations, participations in physical activity, community organisations and initiatives (South Africa. DBE, 2011)

Social and environmental responsibility is a chapter within Life Orientation that has content that is environmental. According to this chapter, citizens have a responsibility of protecting the environment. The irresponsible actions that people engage in lead to pollution, land degradation, changing weather patterns, global warming, drought, floods and many other natural calamities. Threats to community health and safety are illegal waste dumps, keeping and slaughtering animals in unhygienic places, broken sewage pipes and human waste that flows into sources of drinking water like dams and rivers, factories polluting the air and rivers and dumping unauthorised medical and chemical waste.

MrsM-10 claimed that the invitation to the interview with me was the first time she had heard about the ‘green economy’ concept. However, she noted that in Life Orientation there is a chapter with a topic called ‘Social and Environmental Responsibilities’ that focuses on waste management.

“It is for the first time from you to hear about green economy ... however in LO there is a chapter with a topic called Social and Environmental Responsibilities where we talk about waste management ... we talk about how to dispose waste ... we learn about the harmful effects of residing next to a place that emits smoke ... floods that are taking place because of human actions ... winds that destroy human properties s... all of those topics are dealt with in Life Orientation.” (Annexure K, Q4; MrsM-10)

Waste management is an important practice. Learners were also taught about residential areas conducive to good health and those that are harmful to their health. NG-11 agreed that in this subject there is a chapter that deals with green economy content. This chapter promotes

cleanliness. If you are running a business, there must be dumping areas. Companies that manufacture batteries, car tyres and other air pollutants should be far from residential areas so that people are not affected by this pollution as this could lead to massive respiratory-related illnesses. Dangerous materials should not be dumped anywhere but there must be a strategy of locating a dumping site which will be out of reach for children who could be harmed.

4.3.9.2 Doings regarding green economy in Life Orientation

MrsM-10 noted that there is a project they do over two weeks. The learner goes to where she stays and investigate what happens to the waste products that have been disposed of in their community. So they are assigned to investigate how harmful or dangerous are they to humans. In addition, NG-11 said that a learner is required to give examples of the green economy according to his or her own understanding. They are required to do some research and bring some photos so that the teachers can see what they researched about. (See Annexure K, Q4.)

4.4 ENABLING AND CONSTRAINING FACTORS INFLUENCING CURRICULUM PRACTICES RELATED TO GREEN ECONOMY IN THE MECHANICAL TECHNOLOGY STREAM

In this section I present data that shows practice architectures as enabling and constraining factors. These factors are described as practice architectures that shape how teachers deliver green economy related content in the classrooms as means of answering research question 3. I begin with a discussion on Cultural-Discursive arrangements (language used in specific subjects for teaching and learning), followed by Material-Economic arrangements (resources like finance, equipment, time, staff availability and space) and conclude with Socio-Political arrangements (policies guiding teaching and learning, group dynamics, power relations and organisational rules and regulations).

Table 4.1. Practice Architectures as enablers and constraint to teachers' delivery of green economy content in their classroom in Site 1 and Site 2

Enabling factors	Constraining factors
<ul style="list-style-type: none"> • Topics on social and environmental responsibility (C-D) • Recycling, waste management and safety (C-D) 	<ul style="list-style-type: none"> • No prior knowledge of green economy content (C-D) • Inflexible curriculum (S-P)

<ul style="list-style-type: none"> • Adequate workshop space for practical work (M-E) • Diversity in content to be taught (C-D) • Practical work associated with green economy (C-D/ M-E) 	<ul style="list-style-type: none"> • Language in use (concepts/terms) that is subject specific (C-D) • Green economy is dealt as ‘part of’ not as ‘stand alone’ chapter/topic (C-D) • Outdated content in textbooks (M-E)
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4.4.1 Enabling factors

4.4.1.1 Cultural-discursive arrangements

NG-11 said that Life Orientation Work Schedule enabled her to have green economy content knowledge. “Term 3 work schedule on grade 12 Life Orientation there is a chapter that promotes cleanliness of the body and the environment ... learners are required to give examples of the green economy according to their understanding.” (NG-11, analytical memo 11, site 2). MrsM-10 also added that in one of the chapters “there is a topic called ‘social and environmental responsibility’ where we talk about waste management” (MrsM-10, analytical memo 10, site 1).

Recycling, waste management and safety are present in the content of some of the subjects. According to MrMg-3 “we focus on recycling ... waste material shouldn’t be disposed of but should be recycled or taken to a recycling plant” (analytical memo 4, site 1). MsB-7 said that in her subject, green economy content is addressed through waste management, water harvesting, water pollution as well as recycling (analytical memo 7, site 1). MrZ-4 added that there is a chapter in Mechanical Technology which deals with safety, addresses the process of recycling, and reuse a lot (analytical memo 3, site 2).

MrK-6 stated that reading, writing and critical thinking skills that are taught in his subject expose learners to this content. “Learners will be taught essay or summary writing skills but will be reading from a passage with green economy content” (MrK-6, analytical memo 6, site 2). The curriculum encourages active and critical learning which will enable learners to assess and review their green economy knowledge.

For MrsD-8, participation in extracurricular activities has enabled her to integrate what she learns in those projects with the prescribed content of her subject. “... where learners participate in projects like the Eskom Expo, they bring ideas from Science, use them to design and construct projects like water purification, solar and wind energy devices” (analytical memo 8, site 2).

In almost all these subjects, learners must do practical work in the form of Practical Assessment Tasks (PAT) or written or oral presentations. MrsM-10 stated that “learners are given research project which spans five weeks where they have to investigate what happens to waste products in their environments and dangerous effects they have on humans” (MrsM-10, analytical memo 10, site 1). In EGD, learners do a project where they research and design tools to fight land pollution. In Mechanical Technology, learners work in the workshops where they drain oil from engines, cut materials, test gas contents as part of their PAT. Oral presentation and writing of different tasks with environmental content remain as important tasks for assessment in English First Additional Language.

4.4.1.2 Material-Economic arrangements

None of the teachers seem to have space limitation concerns. There seems to be enough space to keep equipment that has been used safely as well as cut-offs that were left over during the practical work. The availability of resources enabled these teachers to enhance what was prescribed on the textbooks. PAT that is done in the workshops also improve the learners’ understanding of the subject matter because they are able transform their theoretical knowledge into practical work.

4.4.1.3 Socio-Political arrangements

Mr V-1 stated that “learners will pen down the idea of a tool for trash recycling” (analytical memo 1, site 1). “Learners will come up with a plan, design and make a living through selling their designs” (Mr H-2, analytical memo 2, site 2). It is worth noting that such activities teach learners about teamwork but also about individual roles in taking care of the environment.

4.4.2. Constraining factors

4.4.2.1 Cultural-Discursive arrangements

According to MrV-1, his subject does not have a chapter that deals specifically with green economy. Mr Mg-3 responded by saying that he did not know much about green economy related content. According to MrH-2’s response green economy “is when you talk about agriculture when you plant. It is about seeds and plants where you use soil” (MrH-2, analytical memo2, site 2) and MrF-5’s response was: “In Agriculture, we learnt about which plant to grow in certain areas because of favourable conditions for them” (MrF-5, analytical memo5, site 2). CAPS curriculum for Mathematics, Technical Sciences and Physical Sciences is prescriptive therefore green economy content is not part of the prescribed curriculum. “It was back in high school where I heard about it... it was not part of the courses that I studied after matric” (MrF-5, analytical memo 5, site 2).

Secondly, in some subjects, green economy content is dealt with as ‘part of’ and not as a full chapter in all the subjects under the Mechanical Technology stream. In EGD, “there are sections in other trades that inform the learners about waste and destroying it in designated areas” (MrV-1, analytical memo 1, site 1). In English First Additional Language, “Green economy is taught as a topic for discussion in activities like essay writing...” (MsB-7, analytical memo7, site 1). In Life Orientation, “In one of the chapters, there is a topic called Social and Environmental Responsibilities where we talk about waste management” (MrsM-10, analytical memo 10, site 1).

4.4.2.2 *Material-economic arrangements*

Topics that have to do with environmental care are important. Teachers in the Sciences feel that their curricula need to be revised to introduce green economy related concepts like recycling because learners reach senior classes not knowing about these important concepts.

4.4.2.3 *Social-political arrangements*

The CAPS curriculum in the Science subjects (Maths and Technical Maths and Physical Science) is inflexible. Teachers are unable to teach beyond the scope of what is prescribed. Chances of co-curricular and subject-integration teaching and learning are limited.

Table 4.2: Enabling and constraining factors that learners experience in the classroom when dealing with green economy content

Enabling factors	Constraining factors
<ul style="list-style-type: none"> • Workshop space for practical work • Integration across subjects • Designated zones for waste disposal 	<ul style="list-style-type: none"> • Limited knowledge about green economy content • Uncertainty about green economy and job opportunities • Lack of resources/equipment • Learner background • Failure to see green economy practices as job opportunities

4.5 CONCLUSION

This section has summarised data relevant to how green economy-related content occurs in some of the nine subjects in the Mechanical Technology Stream. This analysis is based on the content found in the prescribed textbooks used in each of the subjects. The analysis revealed some green economy-related content to be partially represented in these subjects, while in some

subjects there was none. The content prescribed on some of these subjects varies from the usage of natural resources like sun and wind energy to tasks that tested learners' knowledge about environmental preservation and sustainability practices. Overall, green economy links in textbooks were found to be very minimal and teachers' familiarity with the concept of green economy and their experience in applying it in their teaching practices were highly limited.

The following chapter discusses the data presented in this chapter in relation to the theory of Practice Architectures and presents analytical statements that seek to answer the study's research questions.

CHAPTER 5

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 OVERVIEW OF THE STUDY

The purpose of this study was to investigate how curriculum practices in the Grade 12 Mechanical Technology (MT) stream prepare learners to participate in the green economy opportunities in the Eastern Cape. This study focussed on two sites in the OR Tambo District Municipality. It involved 12 teachers and 14 learners from these sites. Semi-structured interviews from the teachers and school leavers formed the core of the investigation. Document analysis and focus group interviews were also used as data collection tools. All interviews were recorded and later transcribed verbatim. Transcripts were analysed and described as indicated in Chapters 3 and 4.

In this chapter, I critically examine and provide insights that have been gained from the data that was presented in the previous chapter. This investigative work aims at developing and providing more insights that will be useful for continuing studies on how curriculum practices enable green economy in schools. I begin by reminding the reader about the main research question and its sub-questions. Each of the sub-questions of this study, are accompanied by analytical statements and these analytical statements are elaborated further in the pages that follow.

SUB-QUESTION 1:

What are the opportunities that exist in the OR Tambo district for school leavers to participate in the green economy opportunities?

5.1.1 Analytical Statement 1: Green economy opportunities exist but are limited and not well-known in the OR Tambo District Municipality

Evidence that has been presented in Section 4.2, while not comprehensive, is indicative of typical green economy initiatives in the district. Similarities between green economy and renewable energy concepts allowed for a discussion on green economy based on renewable projects taken up by the OR Tambo District Municipality. Numerous projects have been enacted and implemented in other parts of the Eastern Cape province. In the energy sector, as

stated in Section 4.2.2, there have been renewable energy projects put into operation in different parts of the province.

According to Daniel (2020), the Eastern Cape Province is emerging as a major source of electricity. Electricity is generated in the areas that form the interior of the province, namely Cookhouse, Molteno, Sterkstroom and Port Elizabeth (Daniel, 2020). Secondly, an ethanol project was established in Cradock for the injection of biofuels into the national liquid fuels supply. However, there is a hybrid-energy system in the OR Tambo region which is found on the Wild Coast called the Hluleka hybrid mini-grid system. The province as a whole shows potential for growth in the use of alternative sources of energy rather than dependence on coal mining.

Overall, green economy knowledge is very limited from the communities of the OR Tambo District Municipality. Several teachers, and past and present learners who were interviewed, had varying interpretations of the concept. “I don’t remember having a chapter that specifically deals with green economy” (see Annexure K, MrV-1, site 1). Other colleagues mentioned that it was not part of their teacher training curricula (Annexure K, MrF-5, site 1) and another colleague had a different interpretation of the concept as he associated it with another field of study (Agriculture) and related it with what happens in Agriculture (see Annexure K, MrH-2, site 2). To some colleagues it is not even part of the curriculum (Annexure K, MrsD-8, Mr Nom-9, Mr F-5). So in most of these subjects it is not taught. Even the literature that is available on these opportunities seems to suggest that this area of the province does not have many of these activities.

5.1.2 Analytical Statement 2: Renewable energy projects play a key role in job creation and improvement of the rural communities’ well-being

According to Edkins, Marquard and Winkler (2010), renewable energy has introduced potential jobs through processing raw materials, manufacturing technologies and plant construction which can offer solutions of ensuring growth and decarbonising economics across the globe (IRENA, 2016). These renewable energy projects are often located in the rural areas and they potentially play a key role in creating jobs and improving the well-being of society, especially rural communities. High levels of renewable energy consumption may create job opportunities through installation of devices, routine maintenance of energy generating instruments and upgrading of energy generating instruments by artisans and more qualified professionals. The

Eastern Cape is evolving in this sector and many renewable energy projects have been implemented. There are wind farms, hybrid energy systems and emerging biofuel projects within the province. Evidence in Section 4.2.2. indicates that renewable energy projects are often located in the rural areas. This is because foreign investments usually target the marginalised and impoverished rural communities.

Analytical Statement 3: Rural communities rely on livelihood practices rather than income-generation, through formal employment

Livelihood practices refer to “the capabilities, assets (including both material and social resources) and activities required for a means of living” (Chambers & Conway, 1991). In the OR Tambo District, many people rely on livelihood practices such as vegetable gardening, livestock production and applying trades and crafts to generate income for subsistence. Some families have home gardens which are considered to be a community’s most adaptable and accessible land resource and important towards reducing vulnerability through poverty and ensuring food security (Adekunle, 2013). These home gardens are an important but often overlooked dimension of the green economy because they provide income and sustenance throughout the year for these rural communities through commercialisation. Self-employed family members are able to sell their crops in local markets at prices determined by them. In addition, they are able to save on spending as some crops for homestead consumption are from these gardens. These food gardens increase production, improve household health and nutrition but also generate income (Adekunle, 2013).

It is important to note that the learners who participated in this study chose technical and vocational-oriented education with the assumption that even if they were unable to further their studies, they would have been trained and equipped with skills that would enable them to be self-employed (see Annexure L, Q7 & Q10 with all of the participants’ responses). Acquired knowledge gave these learners ideas about entrepreneurship. There are certain tasks that they had been required to do so that they will be able to sell and generate income for themselves (Annexure M, Q29-SK5). For example, acquired knowledge enables the learners to design mobility equipment for the physically handicapped members of the communities. Another project that they had to do was to create a dustbin from aluminium (Annexure L, Q7-AT1). This could present business opportunities for these school leavers as their foundation in Mechanical technology subjects could give them access to entrepreneurial activities in the

manufacturing industry. Even though they may not be formally employed, they are able to create their own income-generating opportunities.

5.1.3 Analytical Statement 4: More qualified professionals are needed in OR Tambo District to address challenges of natural resource management and service delivery

Absence of an effective water resource management plan and the lack of systematic drought risk management planning increase the demand of water usage and resultant widespread water shortages in municipalities according to Water Research Commission (2015). There is also non-revenue water defined as water that is produced and enters the distribution system but is never billed to customers because it is lost due to leakages or illegal connections (Tortajada, 2008). This practice is very common in the urban centres of the OR Tambo district municipality. This could be attributed to skills deficits within the water sector or simply the lack of skilled technicians to fix such leakages, insufficient resources, lack of funds to restore burst water supplies and many other factors. Although people are aware of proper water management practice, non-revenue water accounts for excessive water loss in these municipalities. These physical losses of water in the form of leakages from distribution systems and overflows at the utility reservoirs can be caused by poor operations and maintenance, lack of active leakage control and poor quality of underground water supply (Van den Berg, 2015).

In addition, data results in Chapter 4 have revealed that there is room for improvement in water resource management in these local municipalities. Hiring of skilled personnel who have been adequately trained to attend to these challenges would be a starting point. This includes hiring past learners who have received training in services like plumbing or hiring retired professionals who are still willing to offer their expertise to deal with these water-related challenges effectively. Section 4.2.4 briefly outlined some key skills challenges in the agricultural, energy and water management sectors in the Eastern Cape to illustrate the range of potential employment opportunities for learners matriculating from the Mechanical Technology stream. Although the examples are not comprehensive, they suggest that green opportunities do exist but are not well-established as popular or well understood career options for school leavers (see 4.2.2). There is a shortage of skilled professionals to render services within this district. As a result, there is outsourcing of companies as far as the Western Cape and Gauteng whereas there could be local skilled artisans with the necessary skills (Annexure L, Q10-YD9).

SUB-QUESTION 2

What are the sayings, doings and relatings relating to the green economy in curriculum practices of the grade 12 Mechanical Technology stream?

5.1.4 Analytical Statement 5: Some teachers support recycling, waste management and re-use of biodegradable materials

As described in Section 4.3, some teachers on both sites indicated that housekeeping and recycling are essential in all forms of practical work. In Section 4.3.3.3, Mr V-1 stated that some parts are burnt whilst other are stored away after Practical Assessment Tasks or are recycled and sold so that they can earn some income. MrH-2 indicated that, when learners do practical work and do design projects, they design and also sell them because when one designs it as if one came up with one's own idea; it could be good if one sells that idea to the person or company that will assemble that project. In section 4.3.4.1. Mr Mg-3 indicated that in Mechanical Technology they focus on recycling as the metals they work with are recyclable. MrZ-4 also added that the pieces that remain after cutting and welding called "cut-offs" are kept in restricted zones and eventually go to recycling plants. MrK in Section 4.3.6.1. pointed out community members collect waste in the form plastic, paper and glass, sell them to the nearby recycling business and make profit for themselves.

Learners were taught extensively about recycling. All the waste materials especially iron and steel are recycled and transformed into a different product (Annexure L, Q5-AT1; Q5-SG5; Q5-MissM7). Used oil that has been drained into designated containers is sent to recycling plants or an oil refinery where it will be rejuvenated so that it can be used again . There are three types of recycling that learners cover, namely, plastic recycling, steel/ore recycling and waste recycling (see Annexure L, Q5-Maz4). Even within their outdoor gatherings, students learnt to be cautious about littering on the school grounds. They associated environmental protection with discipline and respect (see Annexure O, Q12, SK 01).

5.1.6 Analytical Statement 6: Learners are encouraged to maintain cleanliness and user-friendliness of the labs

In relation to the doings relating to green economy, Mr V-1 expressed that tasks are done in the workshops for PAT (Practical Assessment Tasks) criteria. There are marks allocated for good housekeeping. After PAT or other design tasks, learners need to tidy up and consider the

safety of those that will follow after their lessons. In Mechanical Technology, learners are taught about the importance of keeping their work environment clean and tidy and they have to follow safety regulations on how the workshop is supposed to run. The learners said that they were cautioned against disposing flammable material like gas anywhere. “In Mechanical Technology we learnt that we should not dump gases anywhere and anyhow as this will pollute that certain area” (see Annexure O, Q10, SK 01 and SK 02). The tools and chemicals they use have destructive effects if left unattended. Certain tasks like draining oil and engine overhaul are done in specifically designated areas. The workshops require certain infrastructure and arrangements that will enable such tasks to be done effectively but also with minimal harm to the environment. Waste materials like steel crumbs and cut-offs are kept in storage containers so that they can be dispatched for recycling. Although not directly related to green economy employment or livelihood opportunities, these classroom practices may indirectly develop learners’ positive attitudes and responsibility towards the environment.

SUB-QUESTION 3

What are the enabling and constraining factors that the teachers and learners experience in the classroom when dealing with content related to green economy?

5.1.7 Analytical Statement 7: Cultural-Discursive arrangements of specific subject-related language enable green economy teaching and learning in some subjects

Evidence in Section 4.3 suggest that some subjects that deal with the study of humans in relation to others and society inform learners about responsible citizenship and environmental protection. For example, NG-11 said that the Life Orientation Work Schedule enabled her to gain green economy content knowledge. Work that is done in Term 3 according to the work schedule for Grade 12 Life Orientation has a chapter that promotes cleanliness of the body and the environment. Learners are required to give examples of the green economy according to their understanding. As a class activity, the teacher explains the concept and the learners are expected to relate the explanation with their own examples as a means of demonstrating their knowledge (Annexure N, NG-11, analytical memo11, site 2). In one of the prescribed chapters there is a topic called social and environmental responsibility where there is discussion about waste management.

Recycling, waste management and safety are present in the content of some of the subjects. In Mechanical Technology, there is a focus on recycling and learners are taught that waste material should not be disposed of but should be recycled or taken to a recycling plant. There

is a chapter in Mechanical Technology which deals with safety, and addresses the process of recycling and reuse (Annexure N, analytical memo 4, site 1). One respondent mentioned that green economy content is addressed in the form of tasks that contain waste management, water harvesting, water pollution as well as recycling (Annexure N, analytical memo 7, site 1). In addition, another participant stated that reading, writing and critical thinking skills that are taught in his subject expose learners to this environmental content. Learners are taught essay or summary writing skills but are also required to read from a passage with green economy content. The teacher uses a variety of articles and comprehension passages that have diverse topics to choose from and green economy features as one of the topics of discussion. Such practices encourage active learning, critical thinking and involvement in issues that are related to their immediate environment. This will enable learners to assess and review their green economy knowledge.

Participation in extracurricular activities has enabled certain teachers to integrate what they teach in those external projects with the prescribed content of their subject. For example, when learners participate in projects like the Eskom Expo, they bring ideas from Science, use them to design and construct projects like water purification, solar and wind energy devices (Annexure N, analytical memo 8, site 2). Such opportunities in the ‘architecture’ of the schooling system can inspire learners and lay a knowledge foundation for future potential green career trajectories.

In almost all these subjects, learners are required to do practical work in the form of Practical Assessment Tasks (PAT) or written or oral presentations. In one subject, Engineering Graphics and Design (EGD), learners are given a research project which spans five weeks where they have to investigate what happens to waste products in their environment and the dangerous effects they have on humans (MrsM-10, analytical memo 10, site 1). In EGD, learners do a project where they research and design tools to fight land pollution. In Mechanical Technology, learners work in the workshops where they drain oil from engines, cut materials, test gas content as part of their PAT. Oral presentation and writing of different tasks with environmental content remain important potential tasks for assessment in English First Additional Language.

5.1.8 Analytical Statement 8: Socio-political arrangements can constrain teachers' knowledge of green economy practices, and related environmental issues or activities

According to Kemmis and Heikkinen (2011), educational policy and administration are examples of architectures that influence curriculum practices. The curriculum for the Mechanical Technology stream appeared to constrain green economy opportunities through being prescriptive and inflexible, especially in Mathematics (Pure and Technical) and Sciences (Physical and Technical) (see Annexure N, analytical memo 5, site 2; analytical memo 8, site 2 and analytical memo 9 site 2). Evidence from the participants seems to suggest that there are few environmental topics and activities in their subjects. One respondent noted that his subject, EGD, doesn't have a chapter that deals with green economy (Annexure N, Mr V-1, analytical memo 1, site 1). Correspondingly, few environmental activities happen outside the workshops. The responses from all the teachers were confined to what happens in their workshops and laboratories and did not show evidence of the learning reaching into local context, most especially a local green economy context.

This suggests that the college or university training that these teachers received had limited or no environmental education content. This misunderstanding and absence of green economy content in most of these Mechanical Technology subjects led me to conclude that these educators with no substantial knowledge of environmental issues will be unable to effectively implement it in their teaching. Even those who attempted to explain it, their knowledge and understanding is limited to rudimentary green economy concepts like waste management, water pollution, water harvesting and recycling (Annexure N, MsB-7, Analytical Memo 7, site 1).

5.1.9 Analytical Statement 9: Material-economic arrangements constrain green economy content delivery in the classroom

According to Lotz-Sisitka (2002), contextualised approaches to curriculum development and implementation require a flexible range of Learners Support Materials (LSMs) that can be selected and adapted for use in a local context. Data in this case study suggests that neither the textbooks nor the practical tasks encouraged contextualised approaches. These were considered through the lens of the theory of Practice Architectures which explains that material-economic arrangements like equipment, space, teaching space, teaching aids and financial resources in a site can enable or constrain teachers' practice. When teachers were asked about projects, tasks or assignments that learners did in the labs (see Annexure I), the teachers' responses were

confined to the workshops and spoke about tools only. They did not mention field work, excursions or job shadowing where learners are taken to nearby companies for practical work as part of enhancing their practical knowledge whilst conserving the environment they will be working in. As indicated by Lotz-Sisitka and O'Donoghue (2006), it is important for learners to have proximity experiences that allow them to engage with their surroundings so that they could establish links between their personal experiences and everyday learning context. However, the researcher could assume that lack of resources and the wider material-economic challenges of the school and community within the OR Tambo District constrained such opportunities.

5.2 CONCLUSION

This section concludes and provides recommendations for further research possibilities. The study set out to investigate the extent to which the Grade 12 Mechanical Technology (MT) subject stream prepares learners for green economy opportunities. The objectives were:

- To investigate green economy opportunities for school leavers in the OR Tambo District Municipality;
- To examine the 'sayings' ; 'doings'; 'relatings' regarding green economy in the Grade 12 MT stream's curriculum practices;
- To find out the enabling and constraining factors influencing curriculum practices related to green economy in the MT stream; and
- To recommend strategies that might better orientate curriculum practices of the Grade 12 MT stream to green economy opportunities.

The education that learners leave with at the end of their twelve years of schooling should develop their abilities to find solutions in the 21st design and technological revolution where sustainability of renewable sources can lead to poverty eradication and youth employment. Subjects that are taught within the Mechanical Technology (MT) stream play an important role in developing learners' critical thinking and problem-solving abilities.

This study played an important role in helping the researcher to gain insight into the inclusion or exclusion of green economy content in the Mechanical Technology subject stream. As stated in Section 4.3.2 regarding the Aims and Principles of the National Curriculum Statement,

learners are expected to demonstrate an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation. Secondly, they need to use Science and Technology effectively and critically by showing responsibility towards the environment and health of the occupants (DBE, 2011, p. 6).

In practice, however, the situation as evidenced in this case study is reflected differently. From the case data and discussion presented in Chapters 4 and 5, various conclusions can be made. These are summarised below in the form of findings and accompanying recommendations:

Finding 1: Green economy opportunities in the OR Tambo District range from sustainable livelihood practices to renewable energy and municipal natural resource management and service delivery. However, these opportunities are not well understood or promoted in the Mechanical Technology stream.

Evidence from the research indicates that the nature of the Mechanical Technology curriculum was not designed with the intention to include green economy content. The CAPS and prescribed texts have very minimal content that relates to green economy and environmental education at large. Learners after matric, proceeded to TVET colleges to gain more training on the different trades that they previously studied. The specialised training they received in these TVETs enhanced their knowledge with on-site practical work to expand more on the skills they previously acquired. They enrolled with clear understanding of which career paths they wanted to follow. Though the courses did not have substantial green economy content, they were prepared with skills to partake in green jobs. For example machining and fitting deals with assembling machinery used in agriculture and forestry.

Recommendation: There is greater need to orientate teachers and learners about the importance of the inclusion of the green economy in the school's curriculum. Natural resources like water, air need to be preserved. Electricity that is generated from water and air (hydro-electric and photovoltaic power) is essential for future economic developments like job creation, reduction of socio-economic inequalities and poverty alleviation. Teaching learners green skills in the classrooms lays a foundation of knowledge and values about environmental sustainability, combined with technical skills that may enable them to participate in the green economy.

Finding 2: The environmental content needed to prepare learners for green economy opportunities was limited in the CAPS documents, textbooks, and in the teachers' own knowledge.

The majority of teachers had very little understanding of environmental content in these subjects. Due to limited understanding that respondents had of the 'green economy' concept, exclusion of environmental content in tertiary education curricula, lack of familiarity with the environmental content, inflexible subject syllabus, it can be assumed that the probability of including this concept in learning opportunities is very remote. The study revealed that certain teachers had not received any in-service training in Environmental Education. Even for those who had, the training was insufficient because Environmental Education is not considered as an independent area of learning by policy makers. Instead, it is appended onto other subjects like Life Sciences, Economics and Geography. It is often confined within the Natural and Earth Sciences. This compromises the teachers' role as policy implementers because the teachers become unfamiliar with the Aims and Principles of the National Curriculum Statement in 2005 when the curriculum was reviewed. Successful implementation of environmental content in schools depends on how well teachers understand and are interested in its implementation in their subjects.

Recommendation:

One form of intervention that could remedy the situation would be to integrate environmental content across all the subjects. Teachers can select a topic that will be integrated into their subject area. Then they can identify areas within their subjects which relate to the chosen topic and develop their intended objectives for the inclusion of that topic into the subject. Afterwards, they can determine the content to be taught and how it will be taught. With the assistance of colleagues, teachers can develop new process skills that might be used or developed in order to achieve the new environmental objectives. Teachers and education specialists need to develop teaching resources within their subjects that would facilitate learning about the environmental and sustainability content in relation to their subject content. This could be done through CAPS workshops, seminars or even curriculum conferences. As Ketlhoilwe (2003) stated, such national Environmental goals could include the development of environmental awareness; the acquisition of knowledge and understanding and skills; and the acquisition of desirable attitudes and behavioural patterns in interacting with the environment in a manner that is protective, preserving and nurturing. Given that these goals will be articulated possibly in national policy, teaching and learning, curriculum development and materials development, such processes must take these goals into consideration (Ketlhoilwe, 2003).

Lotz-Sisitka (2011) asserted that subject knowledge and teaching methods need to be updated as teaching occurs in a world that is predominantly complex, uncertain and dynamic. Teachers need knowledge, support and skills through in-service training programmes so that they can adequately and successfully integrate relevant sustainability and environmental content into their subjects. Therefore, the Department of Basic Education should organise professional development programmes for these teachers. Appropriate professional development short courses should be made available in these districts to promote deeper understanding of Environmental Education. These programmes should be facilitated by scholars and researchers in this field of study. Once teachers are thoroughly knowledgeable, they can confidently impart information to the learners in the classroom. They could further devise means to integrate across subjects.

Finding 3: Practical and contextually relevant environmental learning opportunities were limited in the Mechanical Technology stream

The case study indicated that there were insufficient outdoor and fieldwork learning opportunities for the learners in the Mechanical Technology stream, and that this hindered their preparedness to take up green economy opportunities. This could be attributed to lack of funds for excursions and other experiential learning opportunities, teachers' limited knowledge of the value of such activities as well as where and how to access them locally, insufficient learning support materials and the prescriptive curriculum with limited environmental content.

Recommendation:

Learners can also be educated about the environment by visiting places like recycling plants, waste disposal plants and even nature reserves and environmental centres. These field trips are not only enriching but also serve as motivators for the learners. They teach learners important environmental awareness concepts and skills so that they incorporate these field trip and excursion experiences back into classroom activities after returning to school. These trips put learners in different learning spaces that enable them to interact with adults, artisans in the trade or other children for a different learning experience from what they are used to in class. These excursions and fieldtrips cultivate a sense of teamwork with their school mates, learners from other schools or with on-site professionals. Their interest, abilities, creative and problem-solving skills are strengthened. This will hopefully make them environmentally literate citizens who will contribute to environmental development, growth and stability.

Teachers need to be trained in using appropriate teaching methods so as to facilitate effective environmental education learning in the classrooms. Learning should not be passive teacher-centred learning but change active learner-centred learning using a variety of teaching methods. It can start with the use of waste and recyclable material in the classroom activities especially during their PAT sessions. This would teach the learners about the importance of improving the environment and encourage them to live sustainably. As mentioned in Section 4.2.4. South Africa faces water challenges, so learners can be taught outdoor activities like rainwater collection in water tanks. This is beneficial for the school environment as this would contribute to the availability of drinking water and reduce water expenditure bills for the schools. In as much as there are many good environmental practices in South African schools, a lot needs to be improved. More environmentally friendly policies and activities need to be incorporated into the South African school curriculum to make learners more conscious of their actions and the ways in which their actions affect the environment.

5.3 LIMITATIONS TO THE STUDY

This study presented various challenges for me. These started with the difficulty of convincing colleagues to afford me an opportunity for interview purposes. I made several appointments with some colleagues but some were disinterested and refused while others were unavailable during the scheduled times that we agreed upon. The second challenge was the inaccessibility of learners from Site 1 for interviews. As mentioned earlier, the targeted group of past learners are now in different parts of the country. Several attempts were made to locate them, but others had changed their cell phone numbers that they had when they were at school, or they had relocated and changed addresses.

I encouraged the participants to use languages of their choice and most chose to use isiXhosa. This process presented translation challenges. This is because some concepts like green economy, renewable energy do not exist in the vernacular. Green economy was generally unknown so it was a struggle to explain it to the participants for a shared level of understanding. Some participants would enthusiastically veer off the topic and it was quite challenging realign with the interview questions. I had to elaborate extensively to the participants what concepts meant so that we were at the same level of understanding.

Finally, the study's focus on two schools was limited, considering the scope of the research questions. The study could be expanded to include more technical high schools in the rest of the province for a more comprehensive understanding of the potential of Mechanical Technology to prepare school leavers to participate in green economy opportunities.

5.4 RESEARCHER'S REFLECTIONS AND LESSONS LEARNED

This research journey took place in steep, challenging territory for me. I battled with understanding what research was about and more so with the methodologies. Developing an argument and deepening the discussion was the most difficult part, given the broadness and difficulty of my chosen topic and area of research. Ultimately, I learned that research is about making meaning from the sources of information you have. As a researcher, you join a conversation that already exists through making meaningful contributions. It is about thinking deeply and making informed decisions that will prove the worthiness of your contributions. It is a journey, and I hope that this journey has made a small but useful contribution to understanding the relationship between curriculum practices in the Mechanical Technology stream and green economy opportunities in the OR Tambo District.

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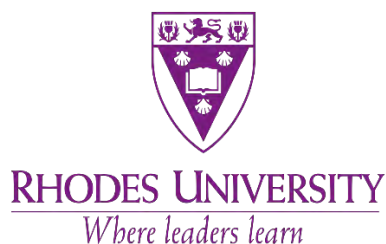
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ANNEXURES

Annexure A



ACCESS LETTER REQUESTING PERMISSION TO CONDUCT RESEARCH

Rhodes University
Drostdy Road,
Grahamstown,
6139

The Principal

Ikwezi Technical Skills Centre

Ikwezi Township

Umtata

Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I am a registered Master's student in the Department of Education at the Rhodes University. My supervisors are Dr L. Olvitt and Prof E. Rosenberg.

The proposed topic of my research is: An investigation into the extent to which grade 12 Mechanical Technology (M.T) curriculum practices prepare learners to participate in the green economy. The objectives of the study are:

To identify factors that enable or constrain curriculum practices that prepare learners for participation in green economy opportunities in the Eastern Cape as well as to enhance the relevance of the Mechanical Technology stream's curriculum through the inclusion of green economy content to better the lives of rural youths in the Eastern Cape. My research activities with the teachers will involve conducting an interview of approximately 30 minutes and

reviewing documents that they provide related to curriculum practices linked to environmental sustainability and the green economy (e.g. lesson plans, textbooks, portfolios) I will get the informed consent of all participating teachers before commencing the research. I hereby seek your consent to allow me to set up appointments with some of your teachers, preferably those who have taught/ are still teaching grade 12, for interviews at their convenient times that will not interfere with tuition. To assist you in reaching a decision, I have attached to this letter:

- (a) A copy of an ethical clearance certificate issued by the University
- (b) A copy the research instruments which I intend using in my research

Should you require any further information, please do not hesitate to contact me or my supervisors. Our contact details are as follows:

Mr. Mcebisi Mkaza, researcher, 0739056514/ 0764165322, mcebisimkaza@gmail.com

Dr Lausanne Olvitt, Supervisor, l.olvitt@ru.ac.za

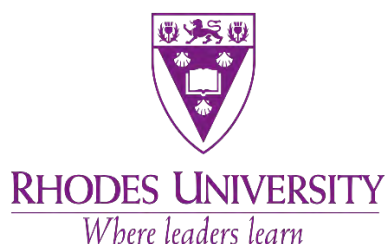
Prof. Eureka Rosenberg, Supervisor, e.rosenberg@ru.ac.za

Upon completion of the study, I undertake to provide you with a feedback .Your permission to conduct this study will be greatly appreciated.

Yours sincerely,

Mr Mcebisi Mkaza

Annexure B



ACCESS LETTER REQUESTING PERMISSION TO CONDUCT RESEARCH

Rhodes University
Drostdy Road,
Grahamstown,
6139

The Principal
Umtata Technical College
Private Bag X 5011
Umtata
Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I am a registered Master's student in the Department of Education at the Rhodes University. My supervisors are Dr L. Olvitt and Prof E. Rosenberg. The proposed topic of my research is: An investigation into the extent to which grade 12 Mechanical Technology (M.T) curriculum practices prepare learners to participate in the green economy. The objectives of the study are:

- (a) To identify factors that enable or constrain curriculum practices that prepare learners for participation in green economy opportunities in the Eastern Cape.
- (b) To enhance the relevance of the Mechanical Technology stream's curriculum through the inclusion of green economy content to better the lives of rural youths in the Eastern Cape.

My research activities with the teachers will involve conducting an interview of approximately 30 minutes and reviewing documents that they provide related to curriculum practices linked

to environmental sustainability and the green economy (e.g. lesson plans, textbooks, portfolios) I will get the informed consent of all participating teachers before commencing the research. I hereby seek your consent to allow me to set up appointments with some of your teachers, preferably those who have taught/ are still teaching grade 12, for interviews at their convenient times that will not interfere with tuition. To assist you in reaching a decision, I have attached to this letter:

(a)A copy of an ethical clearance certificate issued by the University

(b)A copy the research instruments which I intend using in my research

Should you require any further information, please do not hesitate to contact me or my supervisors. Our contact details are as follows:

Mr. Mcebisi Mkaza, Researcher, 0739056514/ 0764165322, mcebisimkaza@gmail.com

Dr Lausanne Olvitt, Supervisor, l.olvitt@ru.ac.za

Prof. Eureta Rosenberg, Supervisor, e.rosenberg@ru.ac.za

Upon completion of the study, I undertake to provide you with a feedback .Your permission to conduct this study will be greatly appreciated.

Yours sincerely,

Mr. Mcebisi Mkaza

Annexure C

IKWEZI TECHNICAL SKILL CENTRE

PRIVATE BAG X 5050

MTHATHA

5099

TEL/FAX: 047-535-9082

30 July 2019

Dear Sir

PERMISSION TO CONDUCT RESEARCH (MR M. MKAZA)

I do not have any objection to the proposal to conduct research at the school. I believe however that the findings will yield recommendations to improve our school.

Yours faithfully

Z. Ndamase (Principal)



Annexure D



Umtata Technical College
New Brighton & Gerald Schultze Road
Ngangelizwe, Umtata
5100
Tel 047-1500090
Email address:
umtata.technicalcollege@gmail.com



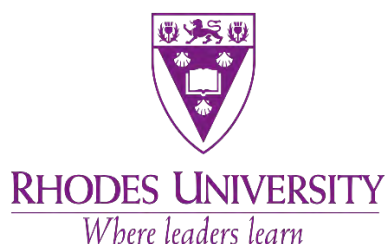
DATE:... 22 July 2019...

TO WHOM IT MAY CONCERN

This correspondence serves to acknowledge the receipt of your request to conduct interviews at our institution. You have been granted permission to conduct those interviews and other related information seeking activities. However, you are requested to uphold ethical practices and be as professional as possible. You are required to give feedback on your study to the teachers as and when you are required. We wish you success on your studies.

Yours sincerely,
22 JUL 2019
Mr N.H NGIBE
PRINCIPAL
(PRINCIPAL)

Annexure E



Mrs N. Dyodo

District Director,

Department of Basic Education, OR Tambo Inland district

Botha Sigcau Building

Mthatha

Dear Madam

RE: Permission to Conduct Research Study

This correspondence serves as request for your permission to conduct research at the following schools: Mthatha Technical College and Ikwezi Technical Skills Centre. I am currently enrolled in the Education Department at Rhodes University and am in the process of writing my Master's Thesis. The study is provisionally entitled: An investigation into the extent to which grade 12 Mechanical Technology (M.T) curriculum practices relate to the green economy. A case study of two Eastern Cape technical high schools.

I hope that the department and school administration will allow me to recruit and interview 18 teachers. If approval is granted, educators will partake in interviews in a classroom or other quiet setting on the school site during school break time or after school. The interview results will be pooled for the thesis project and individual results of this study will remain confidential and anonymous. Pseudonyms will be used for the participants and will be stored securely by the researcher and the university. No costs will be incurred by either school or the individual participants.

Your approval to conduct this study will be greatly appreciated. I will follow up with a visit to your office or a telephone call next week and would be happy to answer any questions or concerns that you may have at that time. You may contact me at 0739056514 or mcebisimkaza@gmail.com If you agree, may you kindly submit a signed letter of permission

on your institution's letterhead acknowledging your consent and permission for me to conduct this survey/study at these schools.

I hope my request will receive your favourable consideration.

Yours Sincerely,

Mr Mcebisi Mkaza

M.Ed. student

Department of Education

Rhodes University, Grahamstown, South Africa

Approved by:

Print your name and title here

Signature

Date

Annexure F



Province of the
EASTERN CAPE
DEPARTMENT OF EDUCATION

ORTAMBO INLAND DISTRICT

Botha Sigcau Building * Office No. 41 * Ground Floor * Mthatha * Private Bag 5003 *
Mthatha * 5099 REPUBLIC OF SOUTH AFRICA * Tel: +27 (47) 502 4206 Fax: +27 (47)
531 3540 * Website: ecprov.gov.za * Email: Nomthandazo.dyodo@ecdoe.gov.za Enq: Mrs
L.N. Dyodo Date: 06 May 2019

TO : MR MCEBISI MKAZA

FROM : DISTRICT DIRECTOR

SUBJECT : PERMISSION TO CONDUCT RESEARCH ON THE EXTENT
To WHICH GRADE 12 MECHANICAL TECHNOLOGY
(MOT) CURRICULUM PRACTICES RELATE TO THE
GREEN ECONOMY

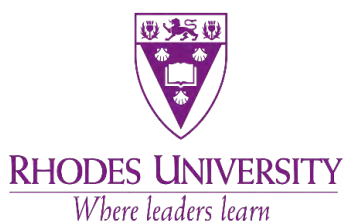
DATE : 06 May 2019

1. This is to acknowledge the receipt of your letter requesting to conduct research at OR Tambo Inland Schools.
2. Kindly be advised that the office has granted you permission to conduct the said research.
3. The department is looking forward to receive a feedback on the investigation that you will conduct on the Grade 12 Mechanical Technology curriculum practices in relation to the green economy especially in the OR Tambo Inland District.
4. Thanking you in advance.

Yours faithfully



Annexure G



INFORMED CONSENT DECLARATION

(Teacher Participant)

Project Title: An investigation into the extent to which Grade 12 Mechanical Technology (M.T.) curriculum practices prepare learners to participate in the green economy. A case study of two Eastern Cape technical high schools.

Mr Mcebisi Mkaza from the Department of Education, Rhodes University has requested my permission to participate in the above-mentioned research project.

I am aware that:

1. The purpose of the research project is to investigate how curriculum practices in the Grade 12 Mechanical Technology (M.T.) stream offered by technical high schools prepare learners to participate in green economy opportunities in the Eastern Cape.
2. Rhodes University has given ethical clearance to this research project and I have seen/ may request to see the clearance certificate.
3. By participating in this research project, I will be contributing towards developing an understanding of the extent to which Grade 12 M.T. curriculum practices prepare rural Eastern Cape youth to participate in the green economy, especially now that there are curriculum reforms taking place in technical education. Hopefully this will enhance the M.T. curriculum relevance in the latest developments in technical education through the inclusion of green economy content to better the lives of these rural youths.
4. I will participate in the project by providing the researcher with the necessary documents and records that might be of assistance to him e.g. teachers' work and other related documents. Secondly, I consent to conducting an interview of no more than 60 minutes with the researcher.
5. I agree to audio-recording of the interviews on the understanding that only the researcher and his supervisors will have access to the recordings.
6. My participation is voluntary and should I wish to withdraw from participating in the study prior to its completion, I may do so without any negative consequences.
7. I will not be compensated for participating in the research, but neither will I be expected to incur any costs through participating.

8. Very minor risks may be associated with my participation in the project. I will be asked to discuss my understanding of new concepts in the curriculum such as green economy, and how my teaching practices align with these curriculum opportunities. This might lead to the feelings of inadequacy if this is not a strong aspect of my teaching, or I might feel anxious about being evaluated.

To minimize this risk, Mr Mkaza has explained to me that his research is not evaluative (i.e. he has no interest in evaluating my professional performance). Instead, his interest is to understand teachers' understandings and experiences of including green economy content in their particular subjects.

Furthermore, I understand that I can withdraw from the research at any point (until the research report is completed) and my contributions to the study will be completely anonymized (i.e. neither my name nor the name of my school will appear in the research report or any related presentations or publications).

9. Mr Mkaza will give me an opportunity to review the sections of the research report that represent me and my experiences, and I will have an opportunity to check and agree to their inclusion in the final thesis. At my request, Mr Mkaza will also provide me with a copy of the final thesis.

10. Mr Mcebisi Mkaza, 0739056514 / 0764165322, will answer any further questions that I might have concerning the research or my participation.

11. By signing this informed consent declaration, I am not waiving any legal claims or rights.

12. A copy of this informed consent declaration will be given to me, and the original will be kept on record.

I, have read the above information / confirm that the above information has been explained to me in a language that I understand, and I am aware of this document's contents. I have asked all questions that I wished to ask and these have been answered to my satisfaction. I fully understand what is expected of me during the research.

I have not been pressurised in any way and I voluntarily agree to participate in the above-mentioned project.

.....

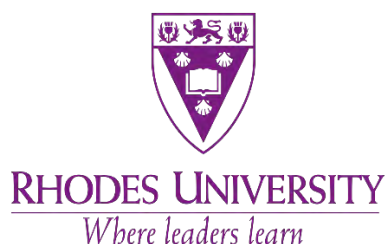
Participant's signature

Witness

Date

Rhodes University, Research Office, Ethics, Ethics Coordinator: ethics-committee@ru.ac.za
t: +27 (0) 46 603 7727 Room 220, Main Admin Building, Drostdy Rd, Grahamstown, 6139

Annexure H



INFORMED CONSENT DECLARATION

(Youth participant)

Project Title: An investigation into the extent to which Grade 12 Mechanical Technology (M.T.) curriculum practices prepare learners to participate in the green economy. A case study of two Eastern Cape technical high schools.

Mr Mcebisi Mkaza from the Department of Education, Rhodes University has requested my permission to participate in the above-mentioned research project.

I am aware that:

1. The purpose of the research project is to investigate how curriculum practices in the Grade 12 Mechanical Technology (M.T.) stream offered by technical high schools prepare learners to participate in green economy opportunities in the Eastern Cape.
2. Rhodes University has given ethical clearance to this research project and I have seen/ may request to see the clearance certificate.
3. I will participate in the project by providing the researcher with the necessary information that might be of assistance to him e.g. my previous years' work, learning experiences and other related documents. Secondly, I consent to conducting an interview of no more than 30 minutes with the researcher. I may ask questions concerning the study both before agreeing to be involved, during the course of the research and after its completion.
4. By participating in this research project, I will be contributing towards developing an understanding of the extent to which Grade 12 M.T. curriculum practices prepare rural Eastern Cape youth to participate in the green economy, especially now that there are curriculum reforms taking place in technical education. Hopefully this will enhance the M.T. curriculum relevance in the latest developments in technical education through the inclusion of green economy content to better the lives of these rural youths.
5. I agree to audio-recording of the interviews on the understanding that only the researcher and his supervisors will have access to the recordings.
6. My participation is voluntary. I understand that I may skip answering any questions that make me uncomfortable and should I wish to withdraw from participating in the study prior to its completion, I may do so without any negative consequences.
7. I will not be compensated for participating in the research, but neither will I be expected to incur any costs through participating.

8. Very minor risks may be associated with my participation in the project. I will be asked to discuss my understanding of new concepts in the curriculum such as green economy in the subjects that I studied during my 12th grade at school. This might lead to the feelings of inadequacy as it will require memory recall from what I learnt in grade.
9. To minimize this risk and potential discomfort, Mr. Mkaza has explained to me that his research interest is to understand past learners' understandings and experiences of including green economy content in their particular subjects.

Furthermore, I understand that I can withdraw from the research at any point (until the research report is completed) and my contributions to the study will be completely anonymized (i.e. neither my name nor the name of my school will appear in the research report or any related presentations or publications)

10. Mr Mkaza will give me an opportunity to review the sections of the research report that represent me and my experiences, and I will have an opportunity to check and agree to their inclusion in the final thesis. At my request, Mr Mkaza will also provide me with a copy of the final thesis.
11. Mr Mcebisi Mkaza, 0739056514 / 0764165322, will answer any further questions that I might have concerning the research or my participation.
13. By signing this informed consent declaration, I am not waiving any legal claims or rights.
14. A copy of this informed consent declaration will be given to me, and the original will be kept on record.

I, have read the above information / confirm that the above information has been explained to me in a language that I understand and I am aware of this document's contents. I have asked all questions that I wished to ask and these have been answered to my satisfaction. I fully understand what is expected of me during the research.

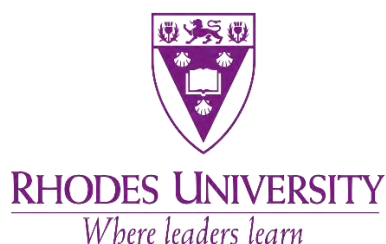
I have not been pressurised in any way and I voluntarily agree to participate in the above-mentioned project.

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Participant's signature	Witness	Date
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Rhodes University, Research Office, Ethics, Ethics Coordinator: ethics-committee@ru.ac.za
t: +27 (0) 46 603 7727 Room 220, Main Admin Building, Drostdy Rd, Grahamstown, 6139

Annexure I



TEACHER INTERVIEW SCHEDULE

Topic: An investigation into the extent to which grade 12 Mechanical Technology curriculum practices relate to the green economy:

A case study of two Eastern Cape technical high schools.

- Thank you for agreeing to participate in this interview
- This shouldn't take more than 30 minutes
- May I record the interview?
- As said before, the contents will be treated with confidentiality

The following information will be completed before the interview.

BACKGROUND INFORMATION

1. (a) Male

1. (b) Female

2. Name of the teacher

3. Subject/s taught

4. Name of the school

5. Time and Date of the Interview

- As an experienced teacher, what are your views with regards to the relevance of what technical education offers to the learners' everyday lives?
- Is the content of what you teach in your subject of use to the learners after matric? If yes, how? If not, why not?
- Does your subject create opportunities for the learners to display their innovative ideas? Please explain.
 - Have you heard of green economy before?

-If No, have you heard about renewable energy projects/ waste management/water harvesting/ recycling and others? Please explain.

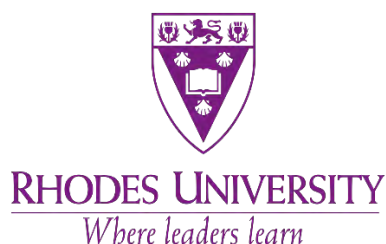
- If yes, please tell me more about it.

- Are you aware of any green economy content in your subject? Please explain.
- Are there any projects, Practical Assessment Tasks (P.A.Ts), assignments that learners do in the labs/workshops that are green economy oriented? If yes, what are they? If not, why not?
- Are there sections in your subject that explain to learners how they can participate in the green economy opportunities available in the province?
- Have you encountered any challenges in teaching green economy content in your subject? Please explain.
- After matric, do you think these learners are equipped and empowered to seize green economy job / business opportunities available in the province? Please explain.
- Does the curriculum enable teachers to teach content that enables the learners to develop solutions to the environmental challenges?
- Does the content of your subject address socio-economic challenges faced by the people in the OR Tambo district? If yes, how? If no, why not?

As we conclude the interview, would you like to add something or share information on the topic of green economy or even technical education?

Thank you so much for your time.

Annexure J



PAST LEARNER INTERVIEW SCHEDULE

Topic: An investigation into the extent to which grade 12 Mechanical Technology curriculum practices relate to the green economy:
A case study of two Eastern Cape technical high schools.

- Thank you for agreeing to participate in this interview
- This shouldn't take more than 30 minutes
- May I record the interview?
- As said before, the contents will be treated with confidentiality

The following background information section will be dealt with beforehand.

BACKGROUND INFORMATION

- | | |
|--|---|
| <ol style="list-style-type: none">1. (a) Male2. Years after matric3. Please confirm that you have matriculated at Umtata technical College/ Ikwezi Skills Centre.4. Please confirm that you have studied English, IsiXhosa, Mathematics/Technical Maths, Life Orientation, Physical Science/ Technical Science, Mechanical Technology and Engineering Graphics and Design.<ul style="list-style-type: none">• How has life unfolded for you after matric? i.e. studied further in a related field/ studied further in a different field? Opened a business? Stayed at home unemployed? Why?• How did your studies prepare you for life after school? Please explain.• Was the content of what you learnt in your subjects of use to you after matric? If yes, how? If not, why not? | <ol style="list-style-type: none">1. (b) Female |
|--|---|

- What are your views with regards to the relevance of what technical education offered to your everyday life?

Now, let us talk about green economy topics like renewable energy projects, recycling, waste management, water harvesting, sustainable economic practices, land management and others:

- During your studies have you ever been taught anything about the green economy? If yes, what was said about it? If No, what do you know about recycling, waste management, water harvesting etc.?
- Were there any projects, tasks that you did in the labs/workshops that were linked to the green economy or green jobs? If yes, what were they? If not, why not?
- Did any of your subjects create opportunities for you to come up with innovative ideas? Please explain.
- Do you think you were equipped and empowered to seize green economy job opportunities available in the province?
- Did the curriculum prepare you to develop solutions to the environmental challenges?
- Did the content of your subjects address poverty and unemployment challenges faced by the people in general?

As we conclude the interview, would you like to add something or share information on the topic of green economy or even technical education? Thank you so much for your time.

Annexure K

Interview between the researcher and teacher participants

Q1-MM: The first question goes as follows: “as an experienced teacher, what are your views with regards to the relevance of what technical education offers to the learners’ everyday lives? “

Mr V-1: Ok thank you sir. Uhm firstly, though am not sure how to begin, firstly this technical education, is something that am not sure whether to say it something that has long been there but not popular or drawing interest but now that it’s becoming popular in schools and as we all know that some schools are now changing to technical education. So now what is currently happening is that back home (in the rural areas “ emakhaya”) parents send their children to these technical schools immediately they hear that their children don’t cope with Maths and other subjects with the belief that they will do hand work, where they won’t be reading and nor do calculations etc things that are related to Maths. Somewhere, somehow these parents lack information because Maths is still part of the curriculum, though technical education specialise with trades and they must do hand work, but Maths and Physical Sciences are still part of the curriculum. So, when I think about technical education, for example, I did civil technology and other trades but I wish there could have been allowance to teach people hand work. Again, according to me, I wish that when these learners leave school they could have skills that will enable to make a living. For example, I also teach woodworking here at schools, so at least timber work, roofing, ceiling fittings, table making and everything that has to do with wood, I wish these learners could leave with that capentry skill. But unfortunately, learners of today, how they study and learn, they do so only to pass the grade than to be skilled. Normally, I would say to them (grade 10-12 learners) for example the textbooks teach us skills like table making and they did that as Practical Assessment Task (PAT) these learners need to develop the necessary skills. In case the learner fails grade 12 at least s/he will be skilled to make a living for themselves. They could even gather together, maybe four in number, and then register their own company. They could do carpentry for an example as ceiling fitters or table making. That what I think technical education is all about. I am not sure whether I answered you properly.

MrH-2: Uhhm when we talk about technical education, the way I see it , it empowers students to have skills so because when you are technically minded or when you know your trades, for example if you know civil technology, there is a lot of things you can do with civil technology, you can be a carpenter/ plumber or also he can construct buildings. So, it empowers them with skills.

MM: it gives them skills so that even after school they can open up their own businesses

MrH: yes they can open up their businesses without even furthering their education after matric. Some of them you will find that they did nt pass grade 12 but they will be having that skill they will use to live after school.

MM: meaning that after school it can be easy, or it becomes a possibility for them to leave school and find work.

MrH: Yes

MrMg-3: Yes, generally with technical education I think it’s one of the subjects that are relevant in modern days because I will take it back to the syllabus that was done round about 2004 and that was NAted 550. In that syllabus, within technical education, there were streams ie woodworking ,electrical, metal work and welding , automotive , fitting & turning but when

it changed to NCS , the syllabus was changed to Mechanical (Technology) and under mechanical ...infact they were changed to Mechanical, Electrical and Civil (Technology)..so under civil there was a portion of wood working, a portion of civil services , a portion of construction. Under mechanical there was a portion of welding, a portion of fitting & turning , a portion of automotive ..then you will find out that in terms of practical work, there is not much practical (work) because they have to do a little practical in welding, a little practical in automotive, and also a little practical in fitting and machining..but currently it has been revised ..now under mechanical (technology) there are specialisations ..there is welding and metal work, there is fitting and machining and also there is automotive. If you are studying welding you are mainly focussing on welding only and even on the practical work that you do ..that means there is more practical work that you will be doing because you are only doing welding , even when you proceed to grade 12 you will be exposed more to welding. So, I think the current syllabus or technical education has positive impact on the learners because if a learner is doing woodworking she focusses only on woodworking.

MrZ-4: Yes in terms of technical (education) relating to the everyday lives it is the most important career in our days in South Africa because we need to develop learners which are technically minded or they are having skills or they are able to work even if they don't get the job they are able to do some of the work on their own . for an example if you talk about someone who is able to change oil in a car basically in mechanical technology..if a learner is having knowledge based on that he can change the oil in his or her own community ..it means that he will generating a certain incentive for himself and be able to live.

MrF-5: Should I be specific to technical mathematics or just technical education?

MM: technical education as a whole.

MrF: I think it is relevant because most of these learners, whilst growing up were being told that the best careers are being a doctor, chartered accountant and also being a lawyer also. We studied in schools where we majored in Maths, Physical Science, Geography, Agriculture without any light for drawing ie EGD , mechanical technology and civil technology. Now when going to university you will find out that engineering graphics & design (EGD) is a challenge to the learners who were doing physical science and mathematics at high school without drawing ..drawing (EGD) becomes the main challenge and many people have failed to do engineering at senior level (tertiary/ varsity level) because they don't have basics of EGD.. technical education addresses such.if one is going to major at university with mechanical technology (engineering) at least they have a "know-how" when talking about mechanical technology . they get to know the different streams with mechanical, civil and electrical technology. That's for one so I think it is very relevant.

MrK-6: I think technical education offers children a great opportunity because first of all , theoretically we would like all of our children to go to higher education but realistically not all of them can get that opportunity, so if they start this technical education they will be able to make a living for themselves using the knowledge that they have acquired at high school level before they reach higher institutions..(MM:..so it is about the knowledge that they acquire at school..) .. yes .i think there is a perception that technical schools also offer maybe handwork but there is also theory there..so they

MsB-7: The technical education to our learners is very much important just because they get skills and there is a lot of practical work ..they get skilled in those technical subjects..they get equipped so that when they go out it is easy for them ..even if somebody is not employed he can create his or her own company and do the practical work

MrsD-8: South Africa is really facing shortages with artisans ..there are no artisans in the country so technical education is really helpful for that particular field of study and we need artisans in the country and they are relevant but the problem is how they are exposed to practicals..are they doing the theory only in the schools because we are training them from the FET level onwards up to the tertiary level..even in the tertiary level we are not sure how much they are exposed to practicals ..we are not at all sure about that..we know at the school level they are not much exposed to practicals ..so that relevance is a big question there because when they are out ..(MM : ..because there are two ways after matric , either work or studies)..they need to get a certificate anyway..they can't just rely on the matric certificate because they do very little as far as technical or trade is concerned at school level..now they need to specialise in that , but even that during the specialisation period, are they really exposed to practicals? So that is a big question..when you are calling someone to come and repair your electrical problems at home (MM: ..plumbing..) anything..it is very rare and they are expensive also but the problem is are they really experienced? Are the jobs that they are going to do..are they perfect? (MM:..which is now the kind of training that TVETs are supposed to be offering)..doing..as far as I know the TVET colleges are getting financial aid from the central (national) government and they have got the machineries but the problem is are those people (teachers) experienced to demonstrate and do those practicals ie the lecturers..because if you are artisan you won't find someone in the teaching field ..they go and start a business. They don't remain in the teaching field at all, so that is the big question..

(MM: Probably you are also thinking that those people who train artisans should come and offer some services to the schools as well..) yes because they are more experienced ..they are always working in the workshops ..they are doing practicals everyday..so but now..even a certain member of our staff called someone from outside the school to come and demonstrate lesson to the learners but I don't have any idea of how far they have gone..

MrNom-9: According to my observations technical education is right.what am I saying so? It is because it teaches the learners skills and secondly I also want to investigate on my own as a teacher because I am coming from a school that didn't offer technical subjects..(MM:..that is your school had academic education..) yes ..then now I want to investigate as to why here the focus is on these subjects..why there are technical maths and pure maths..what is the difference between tech maths and pure maths because I am new in this thing as a whole ..am new in these technical schools..so my target is investigate what is it that the learners will leave having attained here because most of the times in schools where teach at in the rural areas we focus on emphasising that the learner must pass English, Maths and other two subjects..once you pass English and Maths you qualify for university entry because in most university require Maths and English and other two subjects to gain entry..then am interested in knowing why here they are focussing on this..then I am trying to check whether they focus on the because they want learners to matriculate with skills ..then I am also interested in finding out whether are there things that are of assistance to them here at school for them to have those skills (MM:..in terms of resources and equipment..) yes those are some of the things that I want to investigate ..like visiting people who teach technical science to find out whether they do have these things ..to find out what is technical maths and what is behind this technical maths..ok when you study maths , the main focus is on logic..how you put things step-by-step..thats what we are focussing on..

MM: Generally when you look at technical education as a whole what do you think about it..personally how do you feel about it..do you think its relevant, good education that even your child would go through ..is it the kind of education that you would recommend?

MrNom: With regards to today's lifestyles, I can recommend because when a child leaves school she should have a skill so that she will be able to do things with her hands..even at my house I won't have to hire people for some repair work that can be done by someone at home..if she passes well she will go through university education to acquire more knowledge at the university and from there she will for her practicals..then in some universities if they offer mechanical engineering or technology and they have reseources ..am not saying at school there are no resources but am still check for their availability ..so yes I agree that it is relevant.

MrsM-10: I see technical education as right because these learners leave school with skills even in grade 12 so that a person is able to go look for job opportunities without even going to tertiary institutions..it is also advantageous for them when they enrol at universities for courses like Quantity Surveying..i have got my son who is at NMU who is studying for a Diploma in Quantity Surveying..However he is struggling there because at high school he didn't do these technical subjects ..as a result he failed one of his courses namely construction technology.He had to repeat it because he wasn't exposed to these technical subjects..those learners who have done these technical subjects find it easy when they enrol at tertiary institutions especially construction and engineering courses..

NG-11: When we consider technical education especially to the learners it is effective in such a way that it promotes skills on the learners so that they don't focus on being employed but they will do whatever they want to do using their own skills and be able to start their own businesses..so that is what is important about this technical education..it is good especially to the learners everyday lives because of the poor,unstable economy of our country , so the learners benefit a lot..

MrMar-12: Oh thank you Sir..technical education makes the learners to have a clear understanding of what is happening in the industries and it also gives them the background information about the technical subjects that they are going to do at varsity level..it helps them to open up their minds and it gives them an understanding of what is happening in the real life situation.

Q2-MM: The second question says: “ Is the content of what is taught in your subject of use to the learners after matric?

MrV-1: Uhm yes because initially as I have said before, what these learners do is that they want to study now and then forget about it later and pass on. But you will find that in EGD, there is plenty of chapters of which you will realise that within the course (EGD) there is a chapter called Graphics and Communication whereby learners draw a lot as EGD primarily centers around drawing. This is because whatever you do, be it you will construct a house or whatever you will design, you first draw it. EGD helps in that way. I normally say or motivate the learners especially the grade 10s so that by the time they reach grade 12 their mindset is right and that they need to know what it is that they want. For example, I normally say to them in EGD you can design. They can seek relevant information whereby they will open a company or any means of starting up their business. For example, I could start a business with Mr M where we will design house plans. If people want house plans, then they will talk to us and we will draw that. So, this means after matric someone can make money for himself/herself or even now whilst still at school. They could still make money for themselves. They will draw for people especially in the rural areas. In the rural areas it will be know that if someone wants a house plan then there is someone who can draw that house plan, regardless of the number of rooms. There is someone who can draw. When you design, you draw all the views. There are areas known as elevations that will appear on the drawing that show how the house is shaped. Even yourself as the client you can still come to the planner and tell him or her that you wish

your house to look in a particular way. So EGD becomes helpful in that way so that one can draw such house plans.

Mr H-2: Yes it is relevant because once a student completes matric, that student can be able to design floor plans and sell those floor plans because he will be able to design floor plans and he will be able to count how much material will be needed or will be used by the builder so it is relevant and is helpful for them after school. They can also design.

MM: Is EGD only focused on construction or it covers all the different trades?

MrH: It covers all the trades. Some of the students can design, let's say a car, so everything that needs to be designed they will have that knowledge of how to design.

MrMg-3: Yes, it is useful after matric because within our households you will find out that when you go through the gate, there is a gate made..when you proceed to the house, you will find the house has burglar bars on the windows and on the door..so, all of those things are what these learners learn about at high school. They learn about how to weld..if a learner has studied welding under mechanical, she is able to start her own welding business..She can make gates, windows, doors and other things. For example..currently in grade 12 their practical work is the safe..grade 12 welding..in grade 11 they are doing braising stands..so if a learner can do these things properly she can make them and sell them..so this course is helpful..even after matric a learner can start her/his own business.

MrZ-4: Yes it is relevant because you look for example if you talk about a chapter which we normally do in terms of this automotive work of changing oil..doing fault finding..if a learner whilst he is here at high school he is getting that skill because in terms of our curriculum we do teach them, we do practicals with them, they do practicals in terms of knowing how to change oil so in terms of that it assists them a lot..in terms of after they have passed their matric that they can be able to go and work even if they do not get the work..for example some of them they are able to do welding..it's one of other opportunities..they can weld burglar bars, they can weld a lot of things in terms of..they can do a lot for themselves in terms of getting money because they have got the skills especially practical work in mechanical technology and theory.

MM: how balanced is the theory and practical work? Is it a 50/50.50% practical and 50% theory or 70/30..how is it?

Mr Z-4: I would say for now it's not 50/50..I can say that it's almost 60/40 because there is practical assessment tasks (PAT) which is 25% of a learner's marks but there is some practical along their theory after you have finished a certain chapter you have to do practical work in particular..this means that adding those practicals with the practical component the last one it means that there is something like 40% in terms of their practical work.

MrF-5: I think that is where technical mathematics and technical science come in because they have been recently introduced in 2016 in grade 10 and the first group of matriculants was the class of 2018. The familiar example that is normally made to justify the introduction of these subjects is that in 2010 there were many job opportunities in South Africa but only to realise that South Africans didn't have required qualifications for some jobs eg building of stadiums, fixing of roads and all that kind of infrastructure work, this is because South Africans believe a lot in being employed and in working for someone else..so after that the government pushed for the introduction of these subjects..these two subjects are specific for people who are going to specialise in their own fields..mostly technical mathematics and science learners do not go to university but now there are universities that are offering tech maths and science..for example Nelson Mandela University (NMU) gives the same accreditation to tech maths as pure

maths ..level 5 for tech maths is equivalent to level 5 for pure maths..the main reason for the introduction of tech maths and tech science was to produce people who were going to previous Technikons and current universities of technology. They were not going to study and be “office people” but people who would be qualified to be their own” constructors” and all those..these people will be specialists in their fields whether its construction or whatever field of study...maybe electrical or mechanical..basically it was meant for people who were not going to university but who were going to Technikons and universities of technology. This addresses more relevance now obviously to the technical education now because for a very long time some of the learners would come here (technical schools and colleges) and study but only to find out when they are in grade 12 that actually their specialisation is not in the technical side but rather being a doctor ..when they pass their matric some would say that is not what they ..but because they studied pure maths and science then they will be given chance to study whatever they want..otherwise you will find out that it was not really relevant to what they really wanted to study ..but now it is getting more purposeful now that there are most streams..for example in civil technology it has been divided into two streams though before it was just civil (technology) but now they have woodworking and construction , electrical tech has power systems and electronics, mechanical tech has fitting & turning(machining) and automotive ..I believe that our government or whoever is responsible for our curriculum has seen to it that we are not really relevant in terms of how we taught these technical subjects before, hence they are giving it more purpose now and they are dividing it further to more and more specific streams, which makes it easier for the learners also because even if you are going to varsity now they know which stream do I specialise in ..

MrK-6: Yes everything has to do with language..because learners have to present themselves..you know in some instances there are people who are better than the people that we know, but the people that maybe we are more exposed to are able to present themselves ..now language gives them the opportunity to be able to voice out their ideas ,voice out their innovative ideas and also to be able to communicate what they can and cannot do ..so language teaches them presentation as everything has to be presented before it has to be done..every design, every building, every pool/tool there must be communication there ..English helps in that aspect..

MsB-7: English is very much useful to students because in most cases when they are looking for jobs English is the language that is used..even when you are writing a letter or you are receiving an email you get that email written in English ..so English is the most language that is used after matric so it is very much relevant to the learners

MrsD-8:you mean specifically in the technical education? (MM: yes) I don't think they (Physics and Chemistry) because they do very little practical and with practicals not all of them are going to be using that ..that is why they have introduced technical science and technical maths now so that they can be aligned to the technical subjects ...with Physical Sciences on for Engineers maybe ..even for the engineering sections you know the bachelor of engineering..technical education is not all about engineering but it is about the artisans I think..they are two different things..engineering and artisanship..technical education aims on the artisans ..(MM: whereas Science education is more on the engineering) ..on the engineering side..yes..

MrNom-9: (Laughing) I was discussing this with Mrs Goldilocks, my HOD, but why are learners doing mathematics? Ok because most of the times the logic is what they are taught so that learners will be able to do things step-by-step..but if a learner leaves these under-resourced rural schools where we taught besides technical schools, we know that if a learner passed English, passed Life Sciences , passed Physical Sciences that learner will do Medicine... then

why are they doing Maths ? the daily question that we ask is why are doing Maths? Is it because of logic or there is something behind that? That is the question most teachers have .we are saying it is good for a child to study maths so that she can do things logically..

MM: Is there any other skill that you think Maths prepares learners for? Do you Maths does add value to their lives?

MrNom: yes there is and it adds so much value because of the role focus plays..if you are studying maths you need to focus ..even when you are preparing for a maths test, you don't have to cram as they do in Life Sciences, EGD where you have to cram in the subject..in maths you always expect a new question everyday..you don't/can't expect the question that you did in class because there is an addition of a small twist then the question changes completely and then you have to apply ..in Maths the main focus that I can mention now is that learners should apply he knowledge that they already know..(MM: ..and also they are asked to prove for example in Geometry, there are theorems there that they have to prove ..so for every reason they have to justify why they give that particular reason..so it help with their reasoning abilities would you say?

MrNom: yes

MrsM-10: They do especially Life Orientation because LO is about life and how you handle yourself..so it helps them even you have to choose your career..we have career choice chapters..so they are taught particular subject requirements for each career..they are helpful..some come to high school not knowing what they want to be..but because of Life Orientation that is where we tell them what kind of careers they can follow..we also assist with formats and contents of applications..

NG-11: Yes it helps them a lot because in LO we have that chapter that deals with careers and career choices in the first, second and third term, so they emphasize the importance of careers whereas in grade 12 we don't focus on subject choices because we know that begins in grade 10 ..now that you are already in this stream in grade 12 , you should know which stream to follow..maybe you will pursue engineering studies, architecture and many other related fields of study ..so I see Life Orientation as helpful to the learners most of the times..even the department of education focusses a lot on careers and career choices..as LO teachers we used to say the subject advisers need to take this subject seriously..even as teachers we do see that it is helpful to the learners and needs to be taken seriously because whenever our learners fail to choose the right careers we are the cause of that failure ..

MrMar-12: the content of my subject is useful after matric because most of the topics I have taught learners in class gives them background information of what they are going to do at university..it also helps them to open up their minds..if we are focussing on my subject which is Physical Sciences in particular, this subject is a practical subject..there is a lot that they can do for a living using the content of Physical Sciences.

Q3-MM: When you look at your subject, does it create opportunities for the learners to display their innovative ideas?

MrV-1: Yes because EGD normally , as time is everchanging and progressing, initially used drawing instruments and even today we are still using them and there is a Computer Applications Technology (CAT) chapter that deals with computers, so you can do EGD work on the computer and draw on the computer. So, therefore this means, since times are everchanging and we are technologically-inclined in our teaching.

MM: Within CAT who is designing? Is it a program or a software?

MrV: Yes, it is a software. It has everything that has to do with EGD. When working on that software, that needs a person, paper and the information that a person will be working with. Everything is there. For example you will find that we are still using drawing instruments but the learner cannot draw because the drawing equipment is incomplete due to being worn out or theft, so that software the learners are able to do these drawings using that software. This programme is more advanced because when you have mastered its use you can still set questions papers. For an example if you can look at the EGD question papers and when you have that software you will realise that these question papers are set through that software.

MM: So that software is useful even for revision purposes?

MrV: Yes, because you can draw something and print it.

MM: so, they can draw and sell these ideas?

MrV: Yes. For an example I think last year there was a grade 12 learner, and here we were using computers. So this young boy when he draws based on the chapter called Perspectives in EGD. In these textbooks that we get from the government, there is one way of showing someone how the drawing is done, especially the second perspective and how that drawing is done. So this boy, came up with a new dimension on how drawing is done but still gives the same, correct results though the approaches are different. When you think more and more about this child's innovation, it can end up being implemented as an alternative of drawing. This could have financial rewards for the learner. Even as he is studying, he could still make money for himself. But these learners need to stop studying-to-pass approach, but rather use their skills even in the rural areas. They could advertise themselves by drawing and displaying their work. This is also where people will request them to design something for them. They could start it in their rural areas and expand further. This could happen whilst the learner is still at school and will enable him to generate money for himself.

MrH-2: Another thing is that they can be draughtsmen.

MM: Where can they work, uhmm where can they work in terms of opening their own businesses, in terms of working for a construction company or architectural company?

MrH: Yes, they can work in an architectural company, even for construction company especially those construction companies that are building or are starting new buildings, like they are going to build schools or hospitals. They can use someone who did drawing because in order for them to start to build that school they need a design of that school from someone who did drawing, so someone who did drawing is the one who will design that plan for that school or the plan for that hospital or clinic.

MM: So, its roads, buildings, infrastructure as a whole?

MrH-2: Yes I can say everything, especially when it comes to technical everything that has been done, they first did it on a drawing paper.

MrMg-3: yes the learner can be more creative because with the help of EGD (compulsory course for technical stream) even in the mechanical technology subject there is a section on drawing whereby they have to design their own projects except for the compulsory task that they have to do..now when she has passed she can still use her own knowledge to create and come out with his or her innovations so that she is able to create her own artifacts and display them and eventually sell them.

MrZ-4: Yes it does ..mostly as we have now PAT ..PAT assists them in terms of sitting down trying to come up with some innovations or design a certain component where they will sit

down and discuss and go and do some research ..then when they come back they are able to design that particular thing..so it gives them ..there is a scenario they will get and after that scenario they will go and sit down ..for example one of the scenarios which is they normally get which is there is this person who is not having a leg , has one leg now and he needs to push a trolley ..he needs to go and get water from the dam, so it means that they should design something for him so that he is able to carry those buckets or carry that water home. So they should design on their own what they are going to do ..those things it means that now there is a design ..when you look at wheel chairs, it is a design that was made by a certain person ..even we have manual ones and automatic ones that are using a battery..even here in terms of their practical they do have practical which means they have to research and come up with their ideas and then to also go in the workshop and design that particular thing so that you can see that it is working or not

MrF-5: I think a lot. It creates so much space. Firstly tech maths relates more with their trades which is different from the mathematics they have been doing ..there are topics in technical maths that are related to mechanical, electrical.. there are topics that are not there in pure maths that have been introduced in tech maths ..some of those topics are done level 1 at varsity by pure maths students ..for example as we studied during NCS and part of this mathematics we met in varsity but a portion of it is being introduced now to these learners at grade 12 ..also there is a topic called complex numbers there which relates more to electrical tech..those doing electrical tech know about complex numbers ..so it is related to their trade now ie those doing electrical tech.. also if you are talking about mechanical technology there is a topic there which relates to mechanical technology as well which is called angular velocity and circumferential velocity..

MM: do they use this knowledge outside of the classroom?

MrF: yes obviously it is exactly the same thing..there are forces that they have to balance in mechanical tech that they also have to balance them in mathematics in this tech ,maths..even the examples that are made eg angular and circumferential velocity the context there you talk about fans there , talk about windmills but angular velocity is calculated in those windmills and wind turbines and those fans..i believe it is more relevant. If we talk about angular velocity we talk about belts in a car, fan belts..they also calculate those 2 or 3 fan belts found in a car which is more related to mechanical technology now..they easily relate with tech maths and their trade..because for a long time some learners will be saying “ but meneer we have been doing this maths but how does it really relate to what we are doing in our field of work? “ ..so even their examples, if we talk about technical maths even their question papers and their textbooks they have more diagrams than actual mathematics.. so their question papers are more practical ..if you are talking about a topic which is common in mathematics as well but there are diagrams and scenarios to explain further the example that is being talked about..(MM: so these are real life diagrams, scenarios, experiences..even the examples and case studies they talk about what happens in reality..)

MrK-6: I will say yes ..English has 3 papers.. if you go to paper 2 and 3 youll find that it is about what learners think and they ability to analyse things ..so in that way I would say it does give them opportunities to present their innovative ideas. (MM:..that is it makes them to be able to analyse situations ..?)..yes..

MM: what other skills would say language empowers learners with except for communication?

MrK-6: Firstly it helps learners to be able to communicate correctly and be able to present themselves with dignity , and be able to talk to people of different ages and of different categories or standards..and also to be able to analyse different situations as we offer them that

opportunity ..even literature as a whole gives them that opportunity to analyse and then you go also to paper 3..Paper 3 gives them that opportunity to voice out what they think..to come up with different things and different ideas, different situations and recall things that they have experienced in the past..

MsB-7: It allows them to be creative just because we also give them a chance to be creative..for example in essay writing we give them topics and they write ..and you will find that most of the time they write about something they do not know but they have to be creative and do the thing and write it as it is , so they are creative ..it helps them to be creative ..

MrsD-8: Yes surely because especially when they have that skill of doing something ..they can be ..they will be able to..(MM:...is this with Physics or Chemistry or bit of both?) ..no am still on the technical side because technical science for an example they do more practical work than Physical sciences..they are more exposed to practical work but still the problem is they are not doing it ..they don't have the skills of handling the equipment ..so they must have that skill in order for them to become an artisan. I always tell them when I teach them now that they are just spectators , they watch me doing it but I tell them they hold the test tube, you hold that but they are not interested in doing that ..they are more like watching ..but now when it comes to the practical side of the technical subjects (trades) they should be doing (practicals) because you cannot take someone to a workshop and watch someone else doing it..you need to handle the spanner, screwdriver and all of that on your own so that they can get that skill..in that way they will ever be scared ..

MrNom-9: Yes it helps them a lot because when they get come problems, they are able to solve such problems because Maths lessons prepare them to think fast ..when they think they have to reason at the same time..as a maths student you cant just put something without a reason..you have to put a statement then you have to give a reason why are you saying this..why are you doing this.

MrsM-10: Yes ..for example in Life Orientation there is chapter that deals with job shadowing..this chapter informs the learners that if they are doing these technical subjects they should go the nearby companies and learn how job shadowing is done..they get experience for their field of interest..for those doing electrical technology can go to Eskom for experience and skills..you may also request somebody who owns a scrapyards to allow the learners to have a part-time job where they will acquire more skills and then from there they will see how they can develop themselves.

NG-11: Yes the learners are motivated and they are able to live for themselves because , as we are focussing on technical education, if we are talking about mechanical technology and as they do it up to grade 12, after matric someone can be able to develop herself through what she learnt at school and also someone may want to proceed with it through to tertiary institutions or TVETs so this promotes the learners to be independent and they do show interest in what they learn..i am sure of that..our learners can see that our South African economy is not doing well and it needs skilled artisans so they like and want to be independent through being self employed..for example in the rural areas we tend to realise that a grade 9 learners is already able to fix home appliances , so that child display interest and skill on electrical technology ..

MrMar-12: Yes it does create such opportunities for the learners because if you look at the things that we use in real life , turbines used to generate electricity are from Physics and we also have the AC-DC generators ..these generators are used to generate or create electricity ..and it also teaches them about a lot of things that they can do or produce at home eg bath soaps that we use at homes are produced through the Chemistry side of Physical Sciences..

Q4-MM: Have you heard of green economy before? Within your subject, do you talk about green economy topics like renewable energy, waste management, water harvesting , recycling?

MrV-1: Not really. I don't remember having a chapter that deals with such but what I remember but am not sure if it will be relevant is that since we "communicate" through drawing, that will be something like a space here at school where we burn waste . So maybe there could be a learner who could have an idea of designing something that will be useful to the school from that trash. So the EGD learners will be able to pen down this idea that other learners have. They will collectively plan on how about they design something that like this which will enable material recycling.

MM: So meaning those artefacts that will be out together for recycling would have been drawn and designed by the EGD learners.

MrV-1: Yes because that's why I was saying there will be an idea and then they will pen it down . They won't discuss it verbally because when you talk of something , when you construct it you will realise it needs measurements and material. So you will find that you will put together something unstable or even fail. That is why it is necessary for them to draw it down. When they draw it they will know that the distance from different points will vary in a particular way and then they will construct that.

MrH-2: Uhhm, green economy, uhhm am subject to correction. When you are talking about green economy I think you are talking about like in agriculture when you plant , it's all about seeds and plants or it's all about plants green economy where you use the soil . Yes I think it's something that has to do with soil and when you plant something and also ...

MrMg-3: Under the green economy I do not know much about it but the only thing that I understand when it comes to the green economy is that there is a part of recycling within it ..i understand that part when it comes to the green economy.

MM: Let's talk about solar power.. the use of the sun..wind energy.. the use of wind, recycling, waste management, water harvesting ..do you talk about those topics under mechanical technology?

MrMg-3: Under Mechanical Technology, I think the part that we focus on much is recycling because within mechanical we work with metals..these metals are recyclable..so the waste material that the learner has used, she can still use it for recycling since metals are recyclable..so that's where we focus on a lot..on recycling..the waste material that has been used shouldn't be just disposed off..one is able to re-use it or recycle it.

MM: With the electric gates don't you think..there is a problem of electricity in South Africa ..maybe if you can design a solar object that is going to draw energy from the sun so that , that gate can be operated with solar energy.. Don't you have such advanced topics?

MrMg-3: Yes but we don't have plenty of electrical parts ..i think it will only when the learners know much on the mechanical side of things where she can find a group of people from the electrical side who will be able to join forces with her so that she can design the gate..then for it to move she will require assistance from someone who has done electrical technology.

MrZ-4: Yes I do cover green economy ..in our workshops as we work with cars in terms of oil that we use, off-cuts, off-parts that we normally have because we cut materials and we will be having off-cuts which are those small pieces so in our curriculum we do have a chapter which

is called safety where we say that the safety of an employee and employer is so important and at the same time for the environment so we do have a certain way where we deal with that ...

MrF-5: Back at high school I heard about it in Life Sciences but honestly speaking in recent years I have not heard about it..

MrK-6: Yes I am quite exposed to it..(MM:...ok..would you mind to explain further what is it that you know about it?) I know that in my street as I live in town there is a business called Umtata Waste whereby people collect recyclable material there so that is how I would say I am more knowledgeable about the green economy..(MM:...can you tell me more about what is it that they do in this company?) in this company what they do is that people will collect plastics, bottles, cardboards and they take them there to that company and sell them there ..they clean the streets. So they leave the streets clean and the environment clean..they are also making profit out of it..(MM: so people sell this waste material that ordinarily we don't pay attention to and they get remunerated in return..is that what you are saying?)..yes, yes exactly.

MsB-7: Yes I did hear about the green economy before..

MM: What exactly did you hear about it?

MsB-7: It is whereby we are talking about waste management, water harvesting , water pollution , recycling.

MrsD-8: We have heard about that but I don't think the learners are aware of that..(MM:...but you as a teacher can you elaborate as to where have you learnt about it? Maybe you might have heard or read about it somewhere or probably in the CAPS document on the green economy?) ..no not in the CAPS document .. I just heard about it ..(MM: its not a prescribed topic for Physical Sciences) ..no..although the Science Expo nowadays encourages that but even this time in the science expo we didn't see much of that ..they always talk about water purification and solar energy and all but not much..(MM:...so it is more of extra tasks rather than being part of the main curriculum)..yes its not part of the main curriculum.

MrNom-9: No

MM: If not lets talk about concepts like renewable energy, waste management , water harvesting, recycling ..are those concepts familiar? Have you ever taught those in Maths?

MrNom-9: yes when it comes to financial maths we talk about almost everything when we teach financial maths..but for trigonometry, euclidean geometry no, but for financial maths you may come across those things whereby you will be talking about growth and decay in financial maths..where growth is where you get the interest for example when change valueless things to being of value..if we can take old desks and send them to markets then they will start them afresh and make them useful but at school they lose their value with how the learners handle them.. that's what I think. (MM:...so that's the content of green economy that you have ..its in financial maths..)..I can relate..(MM: how big is it? Is it a full chapter? Is it a section? Is it a topic in financial maths?) ..it is not dominant..it is a very short topic that is allocated 15 marks ..so its clear that it is short because other topics are examined for round about 25-35 marks..this one is the shortest carrying only 15 marks..

MrsM-10: It is for the first time from you to hear about green economy..however in LO there is a chapter with a topic called Social and Environmental Responsibilities where we talk about waste management..we talk about how to dispose waste off..we learn about the harmful effects of residing next to a place that emits smoke..floods that are taking place because of human

actions..winds that destroy human properties..all of those topics are dealt with in Life orientation..

MM: is it a full chapter, part or topic in a chapter?

MrsM: its is just a part..

NG-11: Yes..the green economy topic is present in the grade 12 term 3 subject plan ..there is a chapter which promotes cleanliness..so in that cleanliness it is said that if you have a firm there must be dumping areas ..what is to be done with this unused material ? maybe we are producing batteries so the concern is on what has to be done with left-over waste material.. Pollution is the first area of concern when the company is manufacturing batteries..when a company does such productions, the company must be far from areas of residence so that people will not be affected by pollution which can lead to respiratory problems..secondly if maybe when there is a health care centre and there are used needles and other materials they use they must not be dumped anywhere but there must be a strategy of locating a dumping site which will be out of reach for children because once they touch such used material they will be harmed..whenever there are manufacturing factories like in Gauteng ,there must be precautionary and preventative measures in place to prevent a repeat of our invalid brothers who worked at the mines years ago but are no longer fit to work because of respiratory damages incurred whilst they worked at the mines..as a result they stop working at 50 years of age be cause of the “Mine TB”..So in LO we always encourage business people to ensure that the community doesn’t get adversely affected..

MrMar-12: Yes the green economy helps the environment to reduce pollution, creates job opportunities for unemployed people because there we talk about recycling, water harvesting..

MM: In Sciences do you ever talk about the green economy as a chapter or subsection of a chapter?

MrMar: yes we do but in grade 12 it is a small section..it is in grade 10 where it is a full chapter..

Q5-MM:Are you aware of any green economy content in your subject? Is there a topic, or section or a full chapter where you teach about green economy?

Mr V-1: Maybe the way these chapters are structured, I would not really say that there is a stand-alone chapter but we do have a chapter that informs us about career opportunities in EGD and what you could become through studying EGD. Almost in all technical subjects there are chapters whereby that deal with safety but there are certain sections that inform learners in other trades like mechanical technology that tells them that leftovers could still be sold but other will be destroyed as means of waste disposal especially metals.

MrH-2: Yes we did. For example there is something that we call PAT. So when we talk about PAT is when we there is..lets say in this village there is a problem..this village is so dirty, so as this village is so dirty there is also dogs that are ravaging the waste so now we as an EGD person its our duty to design a dustbin that will be able to keep that waste and that dog cant get to that . So we do talked about those things.

MM: Is it , say, a full chapter, or is two or three chapters or is it a section in a chapter?

MrH-2: It’s a project that they do throughout the year, from January because they have to research , design and come up with a solution..research and design.

MM: so that is part of the subject/course?

MrH-2: Yes its part of the course.

MrMg-3: In Mechanical technology I think a chapter that is relevant or related to the green economy, would be a chapter that deals with materials. In that chapter you learn about different types of metals..firstly you learn about you get metals..iron is dug from the soil..initially it is iron ore, then it is purified to make iron then you have different types of metals..ferrous and non ferrous metals ..then ferrous metals contain iron and non ferrous don't have it.. that is what they learn about..they even learn that materials have properties..for example if you want to harden a particular material, you cannot just randomly do so...unless it undergoes heat treatment..they know that there is a certain element to be injected on that material ..so this chapter also teaches them that after certain material has been used you can recycle it. They understand that metals are re-usable and recycleable.

MrZ-4: yes we don't have that specific chapter ..we only have that..mostly it is mostly covered in safety where you will find that safety addresses a lot in terms of this recycling , reuse and all those things so that there ..for the environment to be healthy..because when we teach them it says we should not harm the people and the environment because that is one of the things that are making South Africa to ..or contribute to the disasters that we normally get so we tend to take those things and bury them and then after a certain time ..because some of them are chemicals ..so they tend to explode when they mix ..so you will find that there are those problems.. so in terms of safety under the OHS (Occupational Health and Safety) it is also stipulated that we should always make sure that all this reuse things and we do the recycling ...

MM: So you don't have a specific chapter in mechanical technology that says green economy but its part of different chapters ...

MrZ-4: Yes its part of different chapters its not a specific chapter where we deal of how to do it in tems of they talk about that chapter which is they specify everything ..no..it is just a matter of its always been said in the chapters that when we deal with these things you need to be careful of the environment ...

MrF-5: we did most of that in high school where in agriculture specifically.. I remember when we were taken to a certain kind of a workshop where we were orientated on which plants do we plant in rural areas because obviously its dry that side..which plants can survive for a longer period of time ..because there is really little water on that side..

MM: So you don't talk about these concepts in technical maths ?

MrF-5: No we don't talk about them

MM: Solar energy, wind energy, the use of wind turbines, the use of generators...

MrF-5: yes we talk about some of them but you will find out that the context is different because we are not really discussing about this green economy ..yes..but we are talking about the machine itself.. the velocity at the circumference of that circle ..the velocity at the centre of that rotating circle ..that is all. (MM: not its purpose, not its use in relation to the environment)

MM: So you don't have such content in your subject..?

MrF-5: No we don't have such content in technical mathematics.

MrK-6: In my subject , I would say it is not specifically pointing to the green economy..but in some instances..if I can make some examples ..i remember one when I was teaching them about answering a comprehension, so I read them a story about a young man whom it is said that he made a success of himself out of dirt..it is explained in that comprehension that the boy used to come back from school and started to collect papers, steel and sell them so that he would be

able to go to sleep with something on his stomach..and also to be able to transport himself from home to school..so learners were able to see that you can make a living out of things that you may not necessarily think that they can help us to make a living..they saw that people are able to make money out of dirt, make a living out of it and a success story..

MsB-7: In English we dont teach green economy as a chapter but we teach it as a topic because you will find out that this topic comes out when they are writing essays so we don't teach them as a chapter.

MrsD-8: No..no except for the pollution of water and that's it..

Mr Nom-9- No ..it is not found in our subject.

Mrs M-10..It Is not a chapter but some sections of the course.

NG-11: it is a subchapter on the third term..(MM: ..how is it if you can recall? Do you talk about renewable energy, solar & wind energy, recycling , waste management, water harvesting? Or you focus on specific topics?) ..yes they are specific.. if I can remember we once talked about recycling with the learners where I asked the learners to give examples of recycling processes..they made examples of those elderly women who sometimes collect those soft drink cans and tins so they gave other examples as well as those metals and steel that is usually collected locally and then sent to Durban..this part is a sub chapter ..but there is that part which deals with pollution whereby it is stated whatever manufacturing and production company you have it must not cause harm to people and other living organisms on the environment..

MrMar-12: Yes there are especially if you look at what I have mentioned earlier..the DC-AC generators..they are doing those projects in the lab..they even go outside to compete whilst presenting what they have done..(MM:..how do those generators form part of the green economy?)..it is because they generate energy using wind, water and the sun..natural resources..

Q5-MM: coming to(Practical Assessment Tasks) PAT as you have just said, do you have these PATs or assignments or projects that you do in the workshops/laboratories or any learning space that talk about the green economy?

Mr V-1: Yes, if you can see PAT is done in all grades though too much attention is directed towards grade 12 so you will notice that there is PAT Assessment Criteria . So these Assessment Criteria have marks allocated for good housekeeping as you will see on our trades textbooks. After PAT or other design tasks this means that after they have finished they need to tidy up and consider the safety of those that will follow after their lessons. Some parts are burnt whilst other are stored away after PAT or be recycled and sold so that they can earn some income.

MrH-2: When they design these things, they design and also they sell because when you design its like you come up with your own idea, also you sell that idea to the person that will build that thing..the idea that you have given to them so they design and sell the idea so when they sell the dea, its not like they are selling their design.. so a company or whatever they will take that design and also do what they have already done in the paper. Also there is another thing like uhhh a greenhouse..what we call a greenhouse where you plant seeds and when you plant those seeds you build something (MM where those seeds will germinate and grow) and grow..its not something like ..i cant say it's a garden..its called a green house..it's like a house but in this house a sun can be able to penetrate through and also those seeds can be able to live in that design (MM within that space) yes.

MM: so EGD equips learners to be able to design those greenhouses?

MrH-2: Yes, there's greenhouses, dustbins and also if there is a lot of water that are just a waste..they can design that containers (MM those containers, holders) ..i am just looking for that civil word..uhhm I have forgotten it.. they can design, let's say they can design a borehole..in a borehole you can store water..you can store a dirty water ..you can store a clean water in a borehole..so it can be easy to take that water and clean again so it can be used in that community.

MrMg-3: In a workshop there are rules and regulations of a workshop ..now the learners understand those rules..there are general rules in a workshop.. you know that you don't have to play in and around the workshop if you are using tools..you need to return those tools to their proper place..there is a major rule which is housekeeping..Housekeeping says after you have worked , you cannot leave the workshop as it is..those waste materials need to be collected , returned and properly stored ..tools and cut-offs ...there is a box made available for waste material so that they can be kept in those boxes..also ventilation is important in a workshop..you cant work in workshop that is not well-ventilated because as you work there are fumes that are released..someone else is cutting using the grinder , some is welding on the other side, someone is drilling with the drilling machine so you will find those things in a workshop..so ventilation is important so that as you are working you must work in a good space. We always teach them to always keep their environment clean. They work then 10 minutes prior to the end of the lesson or task they need to tidy up before you leave (housekeeping). Tools are re-assembled and put in their correct storage areas and they need to tidy up and clean the workshop before they leave.

MM: What happens to the cut-offs? What do you do with them?

MrMg: We collect and put them in a box..when there is plenty of them we take them to a recycling plant..for an example, here at school we take them to Dizz..He buys these cut offs.. so you can gather these cut offs and send them to Dizz and we are getting something out of these cut-offs.

MM: Who gets something out of these cut-offs?

MrMg-3: It is the school that benefits

MrZ-4: Yes I would say that we do have ..for example there is a chapter where we use a tester ..for example under practical..there is a tester called gas analyser tester which analyses the gases on a motor vehicle which is we are analysing because after you have fixed the car it means you should check whether it is a complete mixture so that it doesn't affect the environment so we do have under our practical we need to make sure that we do have these testers to test before we can say that the car can go now or the person can try that car ..we need to check is it the mixture of the petrol..is it burning completely or is it half burning that can affect or there is another mixture which is there is an oil that is mixing with petrol that is going to affect the community.

MM: how many such tasks do you have in the entire mechanical technology curriculum for grade 12 ..is it one section of a chapter ..is it two chapters.. is it five chapters?

Mr Z-4: No it is just one chapter because it only talks about that gas analyser ..which is it analyses the gases as they come up..it is just one chapter.

MrF-5: In technical mathematics as much as it is different from pure maths but there are very slight differences..so we don't have experiments in tech maths..what we have is just

investigations and assignments and our investigations do not really address the issue of green economy..obviously as I said the context differs so for us we are questioning the calculations , the machines..we are more concerned about the calculations than their relation to the environment.

MrK-6: not that I call recall of..(MM: lets talk about English..what about essays, summary writing, comprehension passages?) oh yes ..in summaries for example..the summary will not be specifically on the green economy but the one that may happen to be on green economy before, I will be teaching the learners on how to summarise..as we all know that for you to be able to summarise something you must understand it fully..so if maybe you go through the extract which maybe you are supposed to summarise then the learners will see that someone has made a business out of green economy..someone is able to participate in the economy through collecting papers..so the same thing helps you financially and also benefits the environment..(MM..what about essays?) in terms of essays now, after understanding what green economy is , maybe they will answer a question not knowing that it has to do with the green economy..but maybe it is some sort of a business venture..that someone who has made a business venture out of a green economy, maybe it will be phrased in another way in an essay..but if maybe they see the topic has to do with making a living out of collecting these papers then the learners will be able to come up with their own ideas, their own ways of making a living out of the green economy in their essays?

MsB-7: it is whereby we give them or we are having debate or we give them a topic that they research and come to do presentations in class and then write down all those presentations.

MrsD-8: I haven't seen anything in the prescribed syllabus that has to do with those topics..I remember when I was still teaching the grade 10 Physical Sciences there is a topic that talks about magnetism..so I was talking to them about the scrapyards because the scrapyards have got a lot of very big scrap metals so I told them about it..and even in the neighbourhood we do have a scrapyard..so I asked them whether they have seen those scrap metals ..they are not aware..i told them that it is being exported to India ..they are exported to India because they don't have factories in South Africa to recycle them, so they are exported to India and other countries as well but I know that India is one of those countries that take the scrap metals from South Africa ..there they recycle it and return it again to South Africa..sometimes they are surprised but interested as well listening to this kind of things ..unfortunately our syllabus does not talk about such things..(MM:...it doesn't address issues like how to take care of the environment in order for you to even generate your own income)..not only that but the recycling process we are quite used to that ..in India we have been having this recycling process for more than two decades ..so for South Africa I think they have just started recently..even here we have just started collecting papers, plastics, bottles..so the learners are not aware of that..

MrNom-9: No I have to be honest and say no..we only focus on questions on Euclidean geometry most of the times because we always say this financial maths is not for us because most maths teachers are not even good in English so they don't go further in financial maths..they just do it for the purpose of doing it ..(MM: so it is not about calculations now but about discussions in financial maths?) it is about calculations..we focus on calculations more than telling them what it is all about in financial maths..we only focus on calculations..we focus on how to calculate it.

MrsM-10: There is a project that they do over 2 weeks..the learner goes to where she stays and investigate what happens to the waste products that have been disposed off in their community..so they are assigned to investigate how harmful or dangerous are they to humans..some children will go and play on those wrecks and dumping site where they could

get injured..(MM:As they go there do they come up with solutions to these problems? Maybe cleaning up the environment ..).. Noble as it is, but our children are very lazy and they depend on the municipality services for such..

NG-11: Yes we do have such ..(MM:..on the green economy? Do you give tasks specifically on the green economy?) yes there was a part of green economy as I have said that green economy is on that chapter which is on the third term ..the learner will be required to give examples of the green economy according to his or her own understanding..(MM:..was that a lesson or they were required to do some research?) ...they were required to do some research and bring some photos so that we can see what they researched about..

MrMar-12: Yes there are especially if you look at what I have mentioned earlier..the DC-AC generators..they are doing those projects in the lab..they even go outside to compete whilst presenting what they have done..(MM:..how do those generators form part of the green economy?)..it is because they generate energy using wind, water and the sun..natural resources..

Q6-MM: This follow-up question is linked to what I asked previously. Are there sections in your subject that explain to learners how they can participate in the green economy opportunities available in the province? As you teach them these skills, do think they are equipped to do jobs that take care of the environment perhaps in the solar energy plant or wind energy plants as you teach them ?

Mr V-1: Yes they can and are able to, but it's just that it needs someone interested in EGD oriented calculations. Furthermore they still find careers that offer information like what is taught and done in EGD. You may find that there is a company that specialises with solar energy material and that learner could be employed as someone who could design or draw a device that will generate energy. So the manager or company owners will bring ideas then the EGD learner will be asked to draw it. At times when they draw they make plenty of devices to choose from. It also becomes advantageous for the company because the EGD person will offer different sketches for the company to choose from.

MrH-2: Yes, yes we do prepare them because all the thing that they will do there, they will first draw. And taking about drawing there is firstly what we call survey where they will need civil (technology) people. When the civil people go and examine the land , how is the land, in EGD students they can draw that part of that land and they can indicate where there is a contour line , the contour line is high this much and this contour line is high this much which means..drawing..EGD students..drawing students they can also.. I can say drawing students they are needed on that project because everything that they do , everything in that project that they will do, they will first draw it and they will correct all the mistakes in the drawing before they correct the mistakes in the..when they build they will just be building what they have already done in the drawing ..so they will be copying what is already drawn .so if there is a mistake, that mistake..they will find that mistake in the drawing before they build

MM: So they go and survey the land and see whether that land is suitable for that kind of a project..So the learners now are going to draw the equipment that is going to be used there.

MrH-2: Yes..uhhm in EGD they don't survey per se but they can draw before the surveyor goes and survey that land. The surveyor will be having a hint of how the land is because they will have already drawn something like a site plan.(let me check if I done have a site plan here) for example here is just a piece of land. So if a company is coming to do some project or to build something here, this piece of land tells everything.. where they should put..if we are talking about, lets say here we are talking about ..

MM: let us say in this house you are going to put a solar panel

MrH-2: If they are gonna put a solar panel they will indicate that the solar panel should be here ..sewage should be here..(MM water tanks) water tanks should be here, electricity should be here..so there is also a lines of contour line ..those lines they will ..those lines they show how the land is ..is the land flat or is the land (MM: the land is undulating) so by just this piece of paper..everything that the company will need is just here, even the surveyor people before they go there, they know that ok here we have a hill, here we have this thing, we have a hole here , here we have this thing ..all these thing they is done by the people who did EGD.

MrMg: Yes I think it teaches that there are so many opportunities after matric because some of them may not have finances that will enable them to go to university , some of them may not have good results to go to universities..When some of them do not have good results they can still enrol at a college and do Ns..as a result that is why currently in technical education they have even introduced technical maths and and technical science so that learners who are struggling with pure maths and pure science can do technical maths and technical science and automatically those learners they know that they are not going for universities but they will be going for colleges and at the end they are taking this route so that at the ed they can be artisans and we know that artisans do the practical work most of the times

MM: Then what happens to those who cant afford to go to technical colleges and universities?

MrMg-3: For those who cannot go for universities and colleges, this practical work that they have done in grade 12 at least ..this knowledge and understanding that they have can sustain them so that they can start their businesses. IF they have not started their businesses they are able to go to any particular firm ..if say maybe she has done welding or automotive..at least she can go to a workshop/garage where car repairs are done. By doing that she acquires more knowledge .There are learners that we randomly meet that have passed Matric..Upon enquiring about what they are currently doing, they will tell you that even though they have not progressed academically, there is something that they are busy with eg projects that they are doing for example welding ..They even suggest that should we be in need of certain similar services they are available for that..There is a former learner that I had a chat with. He was doing woodworking ..he showed my his portfolio ..they are making built-in cupboards . Upon enquiring further he even told that there a kitchen unit that they were assembling at someones house..so even though he didn't progress academically but the knowledge acquired in grade 12 enable him even after grade 12 to make his own projects

MrZ-4: In terms of that green economy opportunities it doesn't specify anything ..in terms of our chapters which is where it specifies that this is the green economy happening in the places. It makes the workers in a workshop to be seen as safe in terms of they just specify that after you have used the oil don't just spill the oil outside ..just put the oil in big tanks , we take it to other company or that company is going to come and take it and they are going to do something which is it goes to those companies..we don't specify as to say that this is the programme we need to follow ..its like even with those small pieces we take them and give to a certain company that is going to come and collect them and then we are going to go and give it to the other places that will do recycling..

MrF-5: No

MrK-6: I will say yes because in one the tasks that they were given which was a shorter text, they had to write a formal letter to the KSD local municipality and complain about the dirty streets of Umtata..so through that they had to provide ideas on how to clean the town, so when I read some of the learners' letters they said that if maybe a company is hired to collect all the

dirt and to clean all the streets and maybe collect all the recyclable material and be used to reproduce things that maybe we lack in our municipality, maybe re create containers , bottles and many other things that can be used to plastics ..some were able to see that yes that there can be a business made out of this dirt that we see on the streets.. not just cleaning..but another business would be a cleaning company that will just come and clean.They also gave me an idea that maybe someone would be able to collect all the recyclable products and sell them or take them to the municipality to recycle and create new materials or new products.

MsB-7: Yes there are sections even though we don't teach them as a chapter but there are sections whereby you teach the learners about how to look after the environment..they mustn't pollute ..they must not waste water..something like that..(MM Maybe after matric??) after matric they also have to know how to keep the economy in a good condition and they must know the disadvantages of air pollution and the waste of water.

MrsD-8: I think it should be the syllabus and they have to revisit (revise) the syllabus now that the country is into the recycling process..so the learners must be aware of that ..maybe in the lower grades (junior primary) ..am not sure though about them..but in the GET and FET there is nothing there . they don't talk much about it ..learners don't know, otherwise if they knew they wouldnot have been so surprised when I told them about recycling and metals being taken to India and resold back to South Africa.

MrNom-9: NO ..i have to be honest..we don't..

MrsM-10: LO in grade 12 teaches the learners to go tertiary institutions where they will acquire more knowledge so that they can be able to get jobs..

NG-11: before you open a business you need to find out what are the needs of the consumers..so we do that..(MM: do you ever tell the learners that before opening a small business they need to investigate their environment?) ..yes we do talk about that..as a result we made an example that you cant go to the rural areas wher people are still using horses for travelling purposes..so there is no need for you to go and put a workshop there to fix cars because few people have cars..so you need to look at the environment around..if you look in our locality, we are in the surburbs and most people are using cars so if you put your workshop around town or which even location, you will be able to get your business running..

MrMar-12: yes Physical Sciences does equip learners for such jobs..remember I said Physical Sciences is a practical subject..even the turbines that generate electricity are just some of the projects that are done by learners who have done Physics ..so the content does equip learners to go to work for such industries..

Q7-MM: Now coming to the course/subject have you ever had any problems when teaching about renewable energy, recycling, waste management in teaching those topics, especially in that topic that deals with safety whereby the content is not clear to the learners about how the learners can be responsible for the environment?

Mr V-1: There are not major problems as such, but the only challenges that you encounter is that , whilst we theorise about safety, you will find that when they are at the workshops , some of them listen and follow workshop protocol and good housekeeping. But you will find that some do not follow these instructions. That is why sometimes we hear reports about injured learners. As puzzling as it becomes there is question which asks about tidying up the workshop. Those in authority may ask whether the learners do not tidy up after these tasks that are done in the workshop. At times some of the leftovers are disposed off whilst others are stored up for future. I am not sure if I answered you well.

MrH-2: I can say the only challenge that is a ..because when you teach student , you teach them something they don't know..some of them..and you have to make an example for them so that they can have..you have to explain in a case that they will have an example in the mind of what you are talking about , so that is the challenge that we face because we must make them imagine what we are talking about to them , because when we are talking about a contour lines, some of them don't know those contour lines..maybe those who are from rural areas they know but they didn't know that these are contour lines because contour lines you can find them in the farm,especially ..but there is no ploughing taking place these days..you can find this on a hill..so if you are just taking about contour line they will just be confused what is contour line ..so you have to make an example so that they will imagine ooh a contour line we are talking about this thing..also when we are talking about..for example here ..uhhm..oh for example even when we are talking about what we call a site plan where you, it's where you are given a land and you build your houses ...you also have a space for the garden ..when you are talking just about the site plan if you didn't explain that site plan they wont understand

MrMg-3: Yes there are challenges that we are encountering because you will find out that learners have differing ways of behaving..thus the main challenge that we are facing because with some learners we have females and males. When it comes to housekeeping will even say no cleaning is for girls ..its girls who are supposed to be cleaning so those are the challenges that you are facing but at the end we teach them that such tasks if you are in a workshop it is also your responsibility because even girls do come for welding in the workshop..so back in the days this was not taken as work that can be done by males only but girls are also here and they are also welding. Now even cleaning Is not for girls only but boys too..housekeeping is for everyone who is using the workshop.

MrZ-4: Most we talk about these things but you will find that some of these learners were never expsed to them.Sometimes you have to download information from the internet as means of trying to get more knowledge ..(MM: souces that you use here don't cover that...) they don't cover that ..so there is a need to get extra sources and also we need to go the sites so that we talk about something that we known. Once I was asked by a learner who said he had that petrol, diesel and oil have one source..i told him I will not give a clear picture for him to understand by they come from crude oil..all of them are generated from that. Our textbooks are not clear in some chapters so there is a need for additional information from the internet.

MrF-5: No

MrK-6: I woudnt say that it is a challenge but rather a mentality thing from the learners, a wrong perception..now there are people that are unemployed and those that are unemployable ..people that are unemployed are those who cant find jobs and those that unemployable are not eager to empower themselves with knowledge so that they can make a living..what has come from my learners is that they look down on anyone who sweeps the street..they all want to work in offices..that is the challenge..in trying to explain to them how they can make a living out of the green economy it become a little bit of a challenge because sometimes they don't take it seriously because they all see themselves working in offices not applying themselves in cleaning the economy ..in cleaning the environment..they also don't see themselves making money in cleaning the environment.

MsB-7: I think they understood everything ..(MM ..is it something that happens around) it is something that happens around them and they now know how to care of the economy , how to use water and they know that they must not pollute the air..

MrsD-8: It was not teaching as such but I was just giving them some information..it was not part of the syllabus..when I was talking about the magnetism and the scrapyard metals..I was

teaching them about how they are handling such material.. I wanted them to know that there is something that they use to handle those big scrap metals..not by hand so we were talking about electromagnetism so when I was explaining that I thought let me explain that as extra information.

MrNom-9: No it has never been..nope..

MrsM-10: in most instances we encourage and promote the use of Google for them to find the latest information..

NG-11: yes there was a case whereby some of my learners made an example about the issue of mines that were supposed to be opened in Bizana..those Bizana people were against that because they had already inhabited the land and built their houses there ..so one of my learners made an example of that , asking what if someone wants to build a business whereas people were already there? So I said to them I do understand the Bizana (Xholobeni) case but the owner or the partners that were to open the business firstly they would have to relocate those people who will be affected so that they won't be affected by the business and all its operations..they used to do that..that Xholobeni case ended up being an environmental issue which is why the people there are fighting against opening the uranium mine there ..

Mr Mar-12: No because if you look at that section about electricity generation is what happens in the real world..it is what we see in our everyday life, so it is not difficult for the learners to understand such a topic..

Q8-MM: You have produced learners or there are learners that you taught in grade 12 who have matriculated, do you think your subject is able to land these matriculants jobs that are green economy oriented? Does your subject equip and empower them with knowledge and skills to be able to seize green economy jobs / business opportunities ?

MrV-1: Yes it does, but even if the learners does very well in EGD, s/he needs other subjects to accompany EGD in order to be admitted to the particular course s/he wants to pursue wherever s/he may go to or whatever further studies ventures. For example it may be required that EGD must be accompanied by English . Obviously the compulsory subject will be EGD but they will still require English for communication purposes at a certain pass level. Then once admitted at whatever institution of higher learning that is where the youth will receive the gist of all what EGD is about. He may get computerised tasks that require him to draw on the computer as “communication” in EGD is done through drawing.

MrH-2: Ja they will be able to participate because they are able to design (MM: the skill is there to design) and also the skill is there for them to design and when they design they will design something that they can be able to explain..so they can..

MrMg-3: Yes after matric I think they are equipped and empowered to participate in the green economy..they are well equipped with the knowledge they have received whilst doing grade 12. This is because we know that not all of them will be able to go to universities due to aforementioned problems ie some won't have financial means to go but the knowledge they work with. I think another thing that helped was the separation of these subjects ie welding is a stand-alone section , automotive is separated from others as well as fitting & machining is also an independent subject unlike before when they were fused together and made one subject..that was challenging because you would ask a learner's project, and these were small projects . For welding they did small projects that you hold all of it by your hand and fitted in your hand because they wanted to see whether the learner could weld whilst they would have just welded a portion of 10cms.. so that learner would be without a proper understanding of what welding

entails . When they leave school they will be confused with regards to what is it that she or he wants to study or do post matric. However with the current syllabus they know that if they are doing automotive then they will mainly focus on automotive ..so in grade 12 they will have more understanding of the subject. So I think the current syllabus caters for that.

MrZ: In terms of practicals and mechanical technology I think they can fit..but in terms of knowledge on green economy that will be new and that's where they will start..they know that they have to protect the environment by keeping it safe, something that they have already learnt about. In terms of what they have learnt in mechanical technology they can work there but with knowledge about the green economy and work opportunities that will be a challenge. With regards to working then they would be able to work there. For example in recycling plants they can be able to operate the recycling machines but for possible work opportunities they would not know much

Mr Z-4: Yes we do have a chapter even for turbines where we talk about, for example in grade 10 we do have a chapter for pumps, which is those places where they normally use those pumps as means of generating electricity..we do have again another chapter in grade 11 which deals with the turbines.. so they have knowledge about solar panels..they can be hired in those places where they information on how turbines work..so they do have practical knowledge of that. At some stage we did take our learners to those places where turbines are used to generate electricity .. in grade 12 there is a chapter on super chargers and turbo chargers ..so we do have these chapters in grade 10-12 but they are not many.. they are just small chapters that talk about these things .. they can work in these places..at some stage their parts will need service, so they know how to service and change parts especially those who are doing fitting and machining..they are able to do that..they services amachinery..those who do programming that will engage in computer programming..

MrF-5: I think the subject itself is more relevant but because it is a new subject , it is having its own challenges obviously..in terms of how we marketed it to the learners ..obviously because us as teachers as well we were not really even sure which universities really do offer this technical mathematics..say last year..learners would come to me and ask me which universities are more relevant and by then I only knew about the University of Pretoria which also I heard from my subject advisor..i didn't really have a direct information with the university.. I wasn't even sure that it is true but I was glad this year because Nelson Mandela University students came here and I was able now to ask them by myself about technical mathematics. SO I think the learners are more equipped but in terms of careers we have not exposed them that much ..and even the universities have marketed them enough because they are still absorbing tech maths and tech science..so they are not really exposed enough ..otherwise the subject itself I believe its more relevant , it just that it is a matter of us now taking it to the learners..telling them that this is what they can do with technical maths, the careers they can pursue and the universities ..

MrK-6: I would say yes especially if you look at my school where they teach technical subjects..Let look at what is happening currently now..it is said the air has never been cleaner in the world because production has been frozen..water has never been healthier because production has been ceased..the environment has never been friendlier because people are staying at their homes..now these learners are taught maybe about Mechanical, Electrical and Civil technology, but there are safety measures in these subjects..for example mechanical technology has a chapter on safety..in that safety they will see that there is a business opportunity on the safety section because it talks about cleaning the tools..it also talks about

cleaning the workshop and also about the cleaning the place in which you were working on.. you must make sure that it is clean. But the material used there maybe recyclable material..or even material that may help to clean the environment..but now they may not just clean but someone may come with a business opportunity..these learners may then be equipped to make a living out of this..how? they may clean up after the companies..maybe the company may go there to work and then you make a business out of staying there..after you have done working, call me then I will come and clean and also use the recyclable material for monetary gain..

MsB-7: Yes I think they do have the opportunities to find the jobs just because I can see on the way the do things it means they understood everything they know how to keep the economy clean and do the writings and everything.

MrsD-8: I doubt very much because they don't know it ..it is not taught..even myself I had to stop with the extra information because there is syllabus to teach..they are very much interested.. even now awareness is not enough..they must be responsible citizens to follow that ..maybe they can introduce that in Life Orientation..(MM:...because LO is done by everybody...) yes

MrNom-9 MrNom: to be honest..as I was teaching in real rural areas and most of the times Maths teachers only focus on passing the learners other than looking at how learners will apply their knowledge after having passed grade 12 or in future..maybe during motivational talk because that is where you are not talking solely about Maths and about where you apply it in real future..we only talk about if you pass this Maths then in future these are the careers that you are likely to follow..as teachers we don't focus on how it will be applied in future and what you will have but focus on them passing the subject ..then most of the times, after they have passed grade 12, they struggle because they are not able to apply most of the things that we taught them.. I can say as teachers we are failing them because we only focus on passing them with level 7s ..when they get to universities they struggle because they are not able to apply their knowledge..(MM:...what they were taught in the classroom)

MrsM-10: I life Life orientation because it helps them with admission points in some universities..When I preach during the LO classes I always teach them about abstinence to the girls and condomising to the boys..this is a way of preventing diseases and keeping them in good health..this helps them even when they are at tertiary and they must focus on studying especially the girl child.

NG-11: Yes I do give them because not all of them will be able to go to the tertiary institutions..so I make it a point that I provide for those learners who will pass grade 12 or without grade 12 will be able to start their own businesses..so that is what we promote..

MrMar-12: Yes they are equipped as I have just said that Physical Science is a practical subject so they have a lot of practical work knowledge that they can apply in such projects so they are equipped ..

Q10-MM: When we look at the curriculum, especially the prescribed textbooks for CAPS, do you think CAPS enables teachers to teach content that enables learners to develop solutions to the environmental challenges? As you can see we have got a lot of environmental challenges , namely air pollution , climate change, global warming. Does the CAPs curriculum teach you as teachers to make learners aware that there are environmental challenges so that they could be responsible for the environment?

Mr V-1: Yes almost all subjects do have such sections. Even though you may be doing PAT , there is a section that cautions you that you must consider your safety and those around you.

So this is similar to a situation here at school whereby on the sports ground there is a portion where will burn off waste. You will not that there will be persistent smoke and it will not affect the school only but the whole neighbourhood. This means this will affect the whole environment. So that is why big workshops are mandated to have sections of waste storage and disposal so that all these activities don't affect the external environment.

Mr V-1: yes I can say it does. Firstly CAPS and other newly revised curriculum, you will find that with these curriculum reforms there are certain sections that have been renewed and revised though they may not differ from what was offered before.

MrH-2: Yes, yes..

MM: Can you explain maybe further on that..taking care of the environment, taking care of the tools that they are going to use ,the workshop that they are working in..what other environmental concerns do you have in EGD that you teach , that you as teachers teach these learners?

MrH-2: Uhhm I can say...

MM: like when they go out in the ...to actually work in the bigger space than a lab, what are the things that you make them aware of as teachers?

MrH-2: Ok..alright.oh like for example when they work in a bigger lab each and every student..he or she knows about ..he or she knows that ..no..he or she knows the safety precautions when you are working in a workshop. Let us say for example in any workshop they know that they cant , they cant just put grease anywhere,so which means the safety first. Safety for them and safety for the environment because they know if you can put..lets say you are changing car oil..you just change the oil and leave that old oil at that place you know you are making the environment dirty. So they know once an oil has been removed from a car what to do with that oil. They know..also when you are entering a workshop they know what you should wear and what you shouldn't wear..what you should do and what you shouldn't do..

MrH: Yes we do teach them about the environment because when we teach them the first thing that we..you see in EGD there are those tools that we use.. so in order for them to be able to know drawing they should know how to keep safe those tools first, because if those tools they don't keep safe they will just throw it anyway..so once you throw that tool anywhere it will make dirty the environment so that's where start to teach them about how to take care of the things that are around you (MM: and also from there it expands to the environment as a whole) it expands to the environment because when you are doing EGD ..first of all you have to be clean and also you must be someone who can take care of the things that are around you, who can take care of the things that you use and who can take care of yourself.

MrMg-3: Yes it does teach them to develop solutions to the environment because there is a design process that they learn and that design process they start learning it at grade 8 whereby you will be given a scenario with a problem. Then the learners will study , assess the problem and come up with a solution to the scenario and you have to design your own thing to try and solve this problem. So I think they are learning in the design process. In the design process you have to come up with your brief and do your research and after having done research you have to draw and design what you are going to do. At the end you have to make a project, so I think this syllabus caters for such. It makes them to be critical thinkers.

MrZ: Under the practical tasks it is specified that whatever you design or work on, it is always emphasised that you should protect the environment by following the general safety rules and good house keeping.. there is a chapter on good house keeping which tells them how to keep

the workshop in tidy and orderly . even when they are working in their spaces, the Occupational Health and Safety always emphasizes that they should take care of the environment .

MM: So they don't construct , build or invent machinery that they would use as a way of taking care of the environment.. of cleaning and ensuring that the environment is safely kept ?

MrZ-4 : Testers are used for that especially in mechanical technology. We fix cars but we don't design ..after fixing you need to set timing before you can test that car by driving it around. You need to ensure that as you are testing the car the gases that are there are not dangerous to the community, so that is why they use testers even before it goes to the community to ensure that it doesn't have negative impact to the community..so that is how we deal with these dangerous chemicals as well as with petrol as we know that it is dangerous..to some its even dangerous to inhale it so we need to test those things so that it does not negatively affect people around.

Mr F-5; No

MrK-6: I will say yes because the curriculum in English is very broad..the focus may not be on green economy per se but its on their ability to think and analyse things but the things that they have to analyse, some of them have to do with the green economy..so if you get across those things you have to explain them to the learners ..so they can be able to voice their opinions and make up their minds about them after explaining them.. so it does help them to understand the green economy.

MM: What about the teachers as the “drivers” of the curriculum..do you think the curriculum enables them to teach green economy content ? is it part of what they teach or teachers have to devise their own means that are green economy oriented?

MrK-6: They have to devise their own means as I say the content is not solely on green economy, but you will see that through the story the we are reading English it has to do with the green economy or cleaning after ourselves. Let me make an example of a story that I once taught called “ the Darling”..in that story there is character called Pastavalov married to the protagonist called Olenka..His business fell through because he was not able to clean after himself..so the business was deemed to be dangerous to society because they were producing products, that after using them ,they would throw them into the water and that water would be contaminated and people would be poisoned.Through this story learners were able to see that if you have a business you have to take care of it even after making money you must make sure that the environment is well looked after ..you must be able to reach the products that you use and look for possible threats and danger to the humans and the environment .

MsB-7: It does teach the kids on different ways on how to keep the environment clean and they must not pollute the air.

MrsD-8: Not in Physical Sciences..not much..I don't see it because they are being taught Physics and Chemistry ..no it is not there..it doesn't teach them about the green economy..no..its not there..

MrNom-9: we only focus on the subject matter..most of us we only focus on how to make them pass..we don't equip them about life and challenges that are facing the country because most of the times we only tell them that if you only focus on Maths you will get work..if you focus on Maths you will get into varsity.. it is easier because you have Maths then when you arrive at varsity you will be accepted ...then you will study Medicine or Mechanical Engineering ..however we don't tell the learners that when you arrive at university , you have to apply these things..we don't tell them about

that..

NG-11: Yes there was a chapter that dealt with natural disasters.. I remember recent flooding cases in Durban..so after natural disasters life must still go on..i told them that after people had lost their homes and their cars, we need to learn how to pick up from such calamities and continue with life.I told them that even the disaster management department does make provisions to restore people's lives ..

MrMar-12: Yes it does because in the content that we are teaching we are talking about the environmental impact..dangers and solutions..i have mention recycling earlier on whereby we open for the companies that are recycling especially with plastics which form part of polymer chemistry and in that recycling it helps the environment because it minimises pollution and it creates job opportunities for the unemployed youths..

Annexure L

INTERVIEW TRANSCRIPT WITH THE LEARNERS

Q1 MM: How has your life enfolded after matric ?

AT1: I went to the Northlink College in Cape Town where I continued with Mechanical Technology that I studied in high school. I began from N1 because I had failed Maths and Science so I didn't meet the requirements to start from N3 . so currently am doing N5 at the same college.

PN2: 2016-17 I did mechanical engineering at Damelin, East London campus..afterwards I dropped after June because I fell ill..after that I went to Johannesburg where I enrolled at Ekurhuleni West TVET College where I studied mechanical engineering but I couldn't finish again because my elder brother had to come back to the Eastern Cape so I couldn't stay alone that side..Initially I had gone to Gauteng because I wanted to do a driver's licence but because I wanted to further up my studies I ended up enrolling at that TVET more so because after training , there is also on site in-service training after N6.. So I was continuing with Mechanical Technology. However, upon arriving at home in the rural areas there was a learnership from the Department of Education where I applied and got admitted..SO I couldn't go back to Ekurhuleni to complete my course. Instead I enrolled for education because I wanted to teach Technology.

TN3: After matriculating in 2017 as I was doing technical subjects I enrolled at a college and I did Mechanical Engineering therefrom 2018 up to date. I am about to write my N6 exams.

Maz4: Firstly I struggled trying to find a school because I didn't prepare for life after grade 12..i didn't know where I wanted to study ..i did grade 12 aimlessly but with intentions to pass ..after obtaining results confirming that I had passed , the first problem was that I didn't know where I wanted to study and this happened after I had received my results..what I had in my was that I didn't want to study in the Eastern Cape but there was nothing I was doing about that..it was just an idea..time went by in January ..So I went to Walter Sisulu University (WSU) Butterworth Campus on the first day of opening but I struggled to be enrolled because students were on strike so I had to come back home..when I got home and thought deeply about what I wanted, I realised that my mind was split into two because I wanted to go to university but at the same time I wanted to go college because I was aware that these institutions weren't offering the same curriculum..Whilst confused, there were people in my locality who told me about KSD TVET College that is at Libode..So I went there, applied and I was admitted..In began my studies in N3 Mechanical Engineering course..After having enrolled there for 2 weeks I was told that the strike was suspended at WSU and new admissions were made ..Though classes had resumed at KSD TVET in Libode, I changed my mind and left for WSU..but when I got there no tuition had resumed..it was just fun stud so I went back to KSD to continue with my studies as the academic year was in progress..So I studied at Libode for the first trimester doing N3. When I was about to do N4 I realised that I was unhappy with how things were at the college..I contacted my former classmates who had enrolled at the college in Port Elizabeth, enquiring from them where they were with the syllabus and to my surprise I realised we were left behind so I pushed myself because some of what we were doing I had already done before..On the second trimester I decided to change college to another college in Port Elizabeth.. I went there and fortunately for me I was able to enrol for my studies..Though I was enrolled at PE College still I wanted to come back to KSD college..so I de-registered in PE College and I went back to KSD TVET in Libode and registered for my N4.. It was quite difficult because I was doing additional work to what I had studied before ..I failed N4 at Libode and I quit .On the third trimester I left and went back home. Around about October I

decided to look for work rather than loafing at home with nothing to do.. I did my CV, applied at Shoprite Mqanduli and that is where I got the job..I worked as one of the packer up until December then the contract ended and I returned home. Following year I went to Port Elizabeth College where I did my N4, N5 and currently I am doing my N6..

SG5: I went to further my studies at PE College where I enrolled for Mechanical Engineering studies where I began at N3 though I qualified to start at N4 but I was told that the space was full so I requested to begin at N3.

ZV6: After matric I didn't study but I am at home, doing nothing..my intention was to enrol at a nearby college but I couldn't so I wasn't able to further up my studies..(MM:...so you wanted to study something that is related to Mechanical Technology?...)..yes

MissM7: I went to a college when I enrolled for a boiler making course through the N1-N6 at Thekwini College.

MzT8: After grade 12 , from January to March 2018 I did nothing . I was at home but eventually I enrolled at college in April where I enrolled for N1 Mechanical Engineering (Motor & Diesel) course in the second trimester (April-June) then from the third trimester I enrolled for N2.

YD9: I enrolled at PE College on the 3rd trimester N1 mechanical engineering course and currently am about to complete N6..(MM:...so after grade 12 when you had a gap , what were you doing?) I was gathering my thoughts about whether I wanted to study or not as I had not applied after grade 12..

Q2 MM: How did your studies prepare you for life after school?

AT1: Studying at NorthLink College in Cape Townwas a great opportunity for me because I was able to adjust academically because of the prior knowledge that I had attained at high school..For example during our workshop practicals at Northlink, I knew how to behave in the workshop because of the chapter in Safety that I learnt whilst I was still at high school. Prior knowledge also assisted me with how to work with machinery at the Northlink College and that helped me a lot ...I was different from other learners who went to mainstream academic high schools.

PN2: Whilst I was still a high school student, I didn't find those subjects useful.. I even questioned how will they assist me after matric especially the Languages...but when I reached tertiary I realised that languages were useful because one of my courses was a Communication module which draws a lot from languages. Mathematics is done all over from N3- N5 I did Mathematics. For Science there is a section on technical science and the other one on plenty of experiments..its paper 2 for the Matric Science which is the Chemistry section...there isn't much of paper 2 (Chemistry) in the Engineering studies but there is plenty of paper 1, the section with physics and mechanics..and this was very helpful..I must admit I wasn't good in Physics at high school but if it was Technical Science I would have got a distinction because I fell inlove with engineering science because it was based on paper 1 of our high school course (Physics) ... I went as far as N5 at Damelin College but I didn't fetch my results so I reverted to N4 at Ekurhuleni TVET college but even then I didn't write the exam, but I had been planning to go and finish my engineering course but the learnership diverted my plans. So, I opted for enrolling for an Education degree with UNISA. PN: A lot , particularly at Damelin..our lecturer there did confess that she hadn't studied to teach engineering studies , so only did a Science degree and PGCE, so what I studied there , it was similar to revision..unlike

someone who studied Agriculture at high school and then decides that she wants to do Engineering..for me it wasn't difficult at all. There was nothing new.

TN3: When I arrived at college I found that what was taught there and what I learnt at high school to be the same. For example drawing (Engineering Graphics and Design EGD) to be very easy at college compared to what I learnt at high school. I would have set for a test without being taught as a way of showing how knowledgeable I was with drawing. Mathematics was also not difficult but there was a slight change when coming to N5 Maths. Overall I didn't find anything new there in what I studied. Instead they just added to what I already knew.

Maz4: I would say they helped me a lot..at College when I was doing N3 I studied the same way as I did at high school..the curriculum was the same ..what had changed was mechanical Engineering where we dealt with cars as they are and not talk about them in theory..Science, Drawing (EGD) and Maths were still the same as they were in high school..Secondly , at high school we attended Mechanical technology classes at the workshop and did practical work a lot there , the skills I learnt there were helpful..I remember when I came back home during my N3 year at KSD TVET I came home and I found a car that had mechanical problems..my brother had been driving, then he drove it into a valley and its CV joints were broken..i did the repairs, recalling what I had learnt at high school during our mechanical practicals.. so I realised that the knowledge I had acquired was very helpful and that built up my love and passion for the course and I decided that I will pursue it even further..

SG5: They helped me a lot because when I got there I was easy when it comes to my studies because it was a repetition of what I had studied at high school especially what I had studied in grade 11 and 12. (MM: ..which course/s did you find easy ?) ..EGD, Physical Science and Mechanical technology helped me a lot..they were similar to each other..the only subject that changed was Mechanical Technology ..

ZV6: I can say here and there they prepared me but in other instances they didn't..(MM: how did they help you?..) like now I am able to explore about things that I learnt there like changing the wheel, use of the lifting jack, how to set some mechanical functions of a car..

MissM7: You mean how they helped me at college? ..They helped me because when I got to college I didn't struggle as we did some practicals at high school ..so when I got there I realised that technical education is a multi-skilled area of study because you are able to study what you want..

MzT8: My studies were very helpful because there is a lot that I learnt and still learning ..I can still be a teacher at times ..I can still work for industries in boilermaking , machining and fitting sections..I could still work at the mines..I can also design because I did it ..(MM:..at N1 did you feel that what you studied at high school was helpful or you started something new?)..they helped me a lot because what I did there is what I did from grade 10 to grade 12..this developed my interest as my studies progressed and I realised that what I studied at high school is gradually coming out as part of my current studies..

YD9: I didnt struggle with Mechanical engineering and Drawing (EGD at high school) and these made it easy for me to adapt to the learning style that I had to adopt at the college..Because I was struggling with Mathematics and Physical Sciences, I had to start from lower levels of study at college..(N1)..(MM..what made it to be easy for you with regards to Mechanical Engineering and Drawing?..) it is because 80% of what we were taught is what I had already learnt at high school, so I repeated what I already knew up until N5..theory and calculations were the same with what I learnt so it was easy to adapt and that made me to perform even

better and score better grades than I did in grade 12..even in Maths I got good teachers who made me to be able to focus and score good grades..

Q3 MM: Was the content of what you learnt in your subjects of use to you after matric? If yes, how? If not, why not?

AT1: All of my 7 subjects that I did in high school were very helpful..How? At college am doing 4 modules and all of these modules cover all that I did at high school.. For example at high school I did IsiXhosa and I found it to be useful because , though we are not lectured in isiXhosa here but it helps me to communicate with other learners because the majority of us are Xhosa speaking students and we are able to communicate with each other using IsiXhosa. Life Orientation has taught me to be able to live together with people of other races and culture because I learnt about cultural diversity in grade 12 LO.Maths, Physics ,EGD and Mechanical Technology are part of the course that I am doing and these modules that am doing relate to those subjects.English is the medium of instruction here ..

PN2: I can say it has been very helpful because if I didn't have means and ways to further my studies at Damelin as I did, I would probably be stuck here at home with nothing to do..but now I chose to teach this engineering after having noticed that teachers of Technology at junior schools are those who studied way back with outdated knowledge..when you ask certain things they will tell you that they teach it because they needed work not because they like it. ..so as someone who got passionate about it from junior school I developed interest in teaching it and even when I got to high school and tertiary I remained passionate about and was interest in imparting my knowledge to the rural children at high school also because technical schools and engineering studies are found in the cities so I wanted to teach it as a way of also encouraging these learners that after matric they must not just sit at home with nothing to do but they can still do things for themselves..for example at home I am able to assist my father by grinding things in the garage..(MM: ..so you technical education as important? So if you were to choose between academic education vs technical education would you still choose technical education? ..i would chose technical education..even at this moment if I could be granted an opportunity to choose re-enrolled at high school I would still choose technical education and study till I attain PhD in technical education.

TN3: It was worthy and worked to my advantage a lot.(MM..how many courses did you do ?)..I did four subjects namely Mechanical Engineering, EGD, Maths and Engineering Science..Engineering science is made up of Mechanical Engineering and EGD.They have been fused together. Some topics that I was taught is were what I had learnt at high school. So I didn't struggle.

Maz4: Yes it was and even in future I will continue studying Mechanical engineering because I have developed passion for it (MM: ..what are you doing currently that is related to what you studied ?)..there is a lot that I have learnt..Mechanical technology is not based on cars only..it exposes you to a lot of things ..there is something that I noticed when I was working at Shoprite. There are elevators there and I didn't know that the elevators depend on mechanical technology knowledge for operation as well as electrical technology..

SG5: When I arrived at the college I did 4 courses namely Maths, Physical Science, Drawing and Mechanical Engineering..We didn't do Languages..Also when I looked at the city itself I realised that there was and still is a huge shortage of artisans as we studied under artisanship together with our trade tests..So I realised there shortgape is too much..This motivated me to pursue my studies in my chosen field of study so that upon completing my studies I could become employable..(MM: so you mean the course that were studying in PE was preparing you to be artisans?) yes..

ZV6: I can say that they weren't that much useful because now am seating at home and am unable to make use of them..

MissM7: they helped me because there wasn't anything I could do with out Maths and Physical Science and technical subjects..even Mechanical Technology helped me with calculations in some of the courses I did.

MzT8: When I put and analyse all of them collectively especially the technical subjects, 4 of these high schools I continued with them at college..I dropped the languages and Life Orientation..but we did learn communication and life skills especially about good housekeeping ..

YD9: I didnt struggle with Mechanical engineering and Drawing (EGD at high school) and these made it easy for me to adapt to the learning style that I had to adopt at the college..Because I was struggling with Mathematics and Physical Sciences, I had to start from lower levels of study at college..(N1)..(MM..what made it to be easy for you with regards to Mechanical Engineering and Drawing?..) it is because 80% of what we were taught is what I had already learnt at high school, so I repeated what I already knew up until N5..theory and calculations were the same with what I learnt so it was easy to adapt and that made me to perform even better and score better grades than I did in grade 12..even in Maths I got good teachers who made me to be able to focus and score good grades..

Q4 MM: What are your views with regards to the relevance of what technical education offered to your everyday life? Is it relevant for today's learners ?

AT1: Yes because it promotes individual prosperity ,self respect and dignity because within our community when there is someone who needs assistance in machine/car repairs, a person who has gone through technical training is able to provide assistance, thus making extra income for herself and her family..this training makes someone or even a community to be resourceful.

PN2: I can say it has been very helpful because if I didn't have means and ways to further my studies at Damelin as I did, I would probably be stuck here at home with nothing to do..but now I chose to teach this engineering after having noticed that teachers of Technology at junior schools are those who studied way back with outdated knowledge..when you ask certain things they will tell you that they teach it because they needed work not because they like it. ..so as someone who got passionate about it from junior school I developed interest in teaching it and even when I got to high school and tertiary I remained passionate about and was interest in imparting my knowledge to the rural children at high school also because technical schools and engineering studies are found in the cities so I wanted to teach it as a way of also encouraging these learners that after matric they must not just sit at home with nothing to do but they can still do things for themselves..for example at home I am able to assist my father by grinding things in the garage..(MM: ..so you technical education as important? So if you were to choose between academic education vs technical education would you still choose technical education? ..i would chose technical education..even at this moment if I could be granted an opportunity to choose re-enrolled at high school I would still choose technical education and study till I attain PhD in technical education.

TN3: I found technical education to be useful because it deals with things that we see in most times. I see it as very helpful..(MM: given an opportunity to choose between technical education vs academic education, would you still opt for technical education?) ..Yes I would still choose technical education because what I like about technical education it is about what you see practically and enables you to be able to think about something new that you could invent with the knowledge that you already have .

Maz4: Yes I can say so ..firstly if you look at the bridges that we cross on our daily lives, it wasn't civil technology only that was used there, but also mechanical technology..the steel that was used to mount and support those bridges is the work of those who did mechanical technology..if you look at the cars that we have today compared to those from the past you will notice that today's cars use computer boxes whereas those from the past didn't have computer boxes..that made me to realise that there is a strong need for those who studied mechanical technology..(MM when you talk about the steel pipes/rods that support bridges, how do they link to mechanical technology?..) firstly with let look at this course called EGD..in that course there is a modules that deals with rivets..EGD doesn't deal with drawing only..you draw from N1-N4..when you reach N5 it changes to Mechanical Engineering and Design..this now has to do with calculations..you calculate how long will the rivet take before it breaks/wears off, how much load will it be able to support in its "life time"..in those bridges , rivets are used and steel..rivets have to do with combining two metals that are welded ..bar-joint, CV-joint, U-joint and V-joint ..this is how these metals are joined when you want to elongate short pieces..sometimes you can weld but in most bridges, engineers use rivets.

SG5: I think it is important in a situation where you do not have money to continue with your studies, you can use what you have been taught to your advantage and try to open up a small business..this reminds me of my mate back in PE (name mentioned but withheld) who started a service station for Toyota taxis and other cars from the same brand..he couldn't go to tertiary though he studied at a technical high school, so he decided to open a small business so that he could be able to use what he had learnt at school..

ZV6: I can say yes..(MM:...maybe take us back to grade 9 when you were at junior school, why did you choose this school? I wanted to do technical especially Engineering studies..and technical education is relevant and important these days.. I can say here and there they prepared me but in other instances they didn't..(MM: how did they help you?..) like now I am able to explore about things that I learnt there like changing the wheel, use of the lifting jack, how to set some mechanical functions of a car..

MissM7:It is very helpful because it enables you to be able to do things on your own ..you dont have to study further for other things because it was what your livelihood is about..what we learnt at high school helped us at college because when we got there we realised that we already knew some of the things done there and enables you to display your talent..most times you use what you already know.

MzT8: Let me start from this point..even from my childhood I grew up staying with my uncle who was a car mechanic..so I lived with him most of the times as he was fixing cars..even during my junior years at school I liked Technology a lot because what we learnt is what I did with my uncle at my spare time..so after junior school at grade 9, that is where I decided that in grade 10 I will follow my passion and study what is of interest to me..which is motor engineering..so at high school I was putting theory to the practical that I knew..

YD9: With regards to different fields of study I can say it helps a lot with preparing your mindset because it keeps your mind active because those subjects are not theory-based most of the times but there is plenty of practical work..you do theory then immediately you do practicals of what you learnt so it keeps your mind active..i think those subjects are good..

Q5 MM: During your studies have you ever been taught about the green economy?

AT1: Yes we were taught about it especially those of use who were in the mechanical technology stream..We dwelled a lot on recycling ..also there was a topic called Terminology where we learnt that if you were using the lab tools during practicals..then the remaining pieces that were cut-offs we had to collect them and put them in a certain container and smear a chemical called Cast Iron..those cut-off after a while change and revert to their original colour and become recyclable..this recycling was done metals especially iron/steel only and not on plastics or other materials. We learnt that you could immerse plastics into fire , soften it and change it into another product ..but we mainly focussed on Terminology which taught us how to protect steel from rust . **They were taught about green economy and the focus was on recycling. Cut offs that they had in the labs were recycled. They don't know that another purpose of recycling is income generation.**

PN2: Yes it was part of the chapter on Safety and especially when we were at the workshops because when we disassembling cars then we needed to be careful of oil leaks and other fluids from the car especially during engine overhaul ...if I remember well even at school there was a workshop with the a furrow where cars where placed so that if there are any leakages then they will drop on that designated furrow and not spill over the work space and the left overs when drained onto containers then dropped off somewhere.. Even during PAT there were those particles that remained after grinding..we had to sweep those steel crumbs to ensure that they are not scattered all over the workshop ..we wore goggles so that the sparks wont fly into our eyes ..we wore worksuits to protect the skin and clothes..all the useless leftovers were put together and dropped off to where they would be burnt. **They know that when working with certain chemicals (e.g. oils, brake fluids etc) you need to careful not to spill them because they are harmful to the environment. Certain areas within the school compound are designated for certain types of job like engine overhaul, oil changes etc. Left over chemicals have to disposed off in zones that are designated for such. The workshop that they worked in had to be kept clean at all times because they were working with dangerous equipment and harmful chemicals. However, they didn't know that burning of waste material is harmful to the environment.**

TN3: Uhm I last dealt with such topics at high school ..when I got to college they didn't dwell much on those..(MM..can you recall what is it that you talked about high school?) I cant really recall what we learnt at high school..(MM:..recycling? waste management, pollution control?? what did you do with the leftovers during your sessions at the workshop?) we would collect the cut-offs ..for example if we were changing oil in a vehicle, we wouldn't dispose it of anyway..we would drain it into a container so that it could be returned to the oil refinery for it to be rejuvenated so that it can be used again ..they would restore its viscosity and other necessary component ..(MM what about the other trash that came out during your practicals? We would not throw that trash away..it is like when you drain oil out of the car, you cant just pour it over some grass as the oil will burnt the grass and on sunny days that oil will release bad odours as it has oil..so what is done such leftovers are taken back to the steel refineries where they recycle them and reuse them.. **They know waste material is harmful to the environment.**

Maz4: I would lie I cant recall that part in any of the subjects I did..I think it is those the came after us probably who had a lesson on green economy...(MM:..did you ever learn about recycling whilst doing you practical work, maybe in the trades or drawing ?) I can recall learning about recycling ..if my memory serves me well I learnt about three types of recycling : first, second and tertiary recycling but that is all I can remember..the first one is where they recycle plastics ..the second one is about recycling steel and the third one is waste..with regards waste management, when I worked at Shoprite in Mqanduli we would put all the delivered

stock at the food storage..each consumable has its expiry date..we would return the expired food to the storage room and then calculate how much wastage has been made..then the manager would decide what to do with that waste..at Shoprite, our manager would give away expired food to a certain gentleman who runs a piggery..then at the end of the year that man would supply Shoprite with pork..that is one way of dealing with waste management..

Recycling.

SG5: There is not much that I can say about the green economy..all I can say in relation to what we used at the workshops , we would cut some material and do burglars , then the pieces that were left unused were sent out for recycling..we didn't throw them away anyhow because they were going to pollute the environment..and they would still be harmful to humans and animals around.. **Throwing away waste material anywhere and anyhow remains dangerous to the environment**

ZV6: yes I remember us talking a bit about these topics in Physical Science as well as Life Orientation..we learnt about how to save water..we learnt about saving paper..we learnt about storing oil after use so that one can sell it to recycling plants and they recycle and reuse it.. **In some subjects like Physical Sciences and Life Orientation they learnt about saving water and paper. Recycling was also taught but not in detail. Re-use of reusable material was encouraged.**

MissM7: We once learnt about recycling. ...(MM:...can you recall what you learnt?) ..there wasn't much that we learnt..we learnt about it in different subjects..we learnt about how must we keep the environment ..and how clean must the environment be..but we didn't do it in greater detail... **the environment that you are working on must be kept clean.**

MzT8: In the theory part of the Mechanical Technology did have a section that talked about that ..for example during our practicals, there was that session where we had to drain oil from the car and water ..we were taught that we should let that oil and water to drip anywhere , especially on the floor of the workshop..Instead used oil is taken for recycling where oil substances are removed then it is renewed with new chemicals then it becomes new oil..even old steel parts that we had removed we were told that they would be burned and recycled to form new material. **Be cautious of the chemicals that you are working with. Certain chemicals like oils, brake fluids and material like steel are recyclable and renewable.**

YD9: We did talk about them especially when we use cutting tools and also during filing ..there is usually that waste material that remains but because we didn't have enough resources to transport them to steel refineries, we couldn't take them there so that we could do something that will assist the school with..even the material that we had wasn't enough..so we worked as groups, we couldn't do individualised work..but our teachers did tell us how ideally the practical would be like if the resources were enough.

Q6 MM:Were there any projects, tasks that you did in the labs/workshops that were linked to the green economy or green jobs? Did you do these projects as your assignments , Practical Assessment Tasks (PATs) ? How did you do them during your P.A.T. sessions?

AT1: For instance in one of our PATs we were given a column that is found on ships at sea ..there was a certain part from a ship that we were assigned to design ..so we had to apply what we learnt in our Safety chapter. Safety is about how you handle the equipment in the workshop. For example we know that we are not supposed to leave the steel crumbs on the floor but we had to gather all the remains and drop them on the container ..even when changing oils from machines we had to dispose it onto containers designed for such waste..so we were doing our PAT but also recycling .. **Whenever they worked in the workshop, they had to extra**

cautious not to harm themselves and guard against damaging the environment. After every task, they had to clean and tidy up the workshop. They had to re arrange the workshop and ensure that every tool that had been used is put back to where it originally belongs. Waste must be dumped into designated containers for waste.

PN2: Yes we did such tasks..so we did those and I kept some of those tasks because I needed to show my parents practical things that we learnt at school..my father wouldn't trust me towards assisting him if I didn't have evidence of the practical work that we did at school..I brought my projects home.

TN3: Waste management..when you are about to cut a work piece you are given certain measurements..and there is what is referred to as tolerance..you will be given a piece and measurement but you wont cut that piece as it is but you will cut it slightly more than actual measurement(tolerance)..

Maz4: Not that I can think of..

SG5: We had such tasks but in the lower grades...I remember learning about that in grade 10 at high school (name mentioned but withheld)..we were manufacturing dustbins.. we were then told that the cut-offs must be disposed in designated bins then our teacher would call a recycling company for these left over for recycling..(MM: did you do anything similar in grade 12?) In grade 12 we couldn't because we lacked machines ..we need certain types of machines..**Not much could be done because they lack machinery and other equipment for their PAT.**

ZV6: There were not such tasks..(MM: you only learnt about them in the textbooks but never did practical tasks on them?) yes..(MM: why didn't you do them practically in the lab?..) I am not sure what made use not to do them in the labs..maybe because our teacher could have been busy..even in the workshops we didn't have enough resources. **Fewer tasks were done because there weren't enough tools.**

MissM7: During PAT you had to follow the safety regulations and learn about how a workshop is supposed to be like..cleanliness and tidiness were important..(MM: what other things did you learnt at the workshop..? ..we learnt that you cant enter the workshop without wearing a worksuit..no eatin in the workshop..(MM:..what was the use of the worksuit?) the worksuit helps during cutting and grinding .. you cant do cutting and grinding whilst wearing the school uniform because there is plenty of work done there. We also worked with oils..you also had to wear welding goggles to protect your eyes .. you had to put all the machinery in place, switch off the machines, clean and tidy up the workshop and look for any oil spillage so that the next group of learners will find the workshop in good condition. **When entering the workshop they had to be dressed appropriately for their PAT. They had to put on their worksuits.**

MzT8: We rarely did those during our practicals..(MM:..whatabout other subjects and tasks? ..aah no I don't remember..

YD9: Yes ..for example in EGD we did have something that linked to it..even other teachers generally commented about it..even in grade 11 we did an investigation on the green economy in our trade and in Life Orientation..In Mechanical Technology we were tasked to do a hammer-head..though it was meant to be done with steel we did it with plastics because there were not enough financial resources for us to buy steel material..we were further tasked to explain how could we protect the environment..and how could we help and give back to the community.. Our teacher split us into groups whilst we worked in the labs..he did so because he wanted us to wear protective gear and also to lessen the emission of gases that contribute to ozone layer depletion and resultant global warming..he emphasised on the cleanliness of the

workshop after work as well keeping it tidy so that the next people to do experiments may find it in good condition. **They were instructed to design a hammer head using plastic instead of steel because there weren't enough financial resources to buy steel .they worked as groups instead of individuals because the school couldn't afford to purchase material that would be sufficient for all of them. They had to tidy up the workshop after each practical work.**

Q7 MM: Did any of your subjects create opportunities for you to come up with innovative ideas? Are there projects that you ended up designing for yourself from the knowledge that you got from your PATs and the subjects that you studied?

AT1: Yes there are ..for example I made a dustbin made of aluminium..what happened is that we were give a plain aluminium sheet and we were required to apply our knowledge from EGD, draw, cut and assemble pieces ...so I did that and assemble those pieces and made a dustbin with handles.. **Out of the Practical Assessment Task they were able to make their own projects. This could open self employment business opportunities for them. What they were taught could give them business ideas to expand their creativity into different sectors like manufacturing, automobile and others.**

PN2: Sometimes I do think about that especially when I go through my books because I still have them ..i sometimes do think about changing how a grinder works to be more user friendly and make it my own invention..however, because I am in rural areas so I have my doubt on who would buy into my idea and advertise them..(MM:...any products that you once thought of?) sometimes we would use plastic instead of steel and I wasn't satisfied with that but I was aware that there were financial limitations to that ..but I had wished we used metal in plastic and reproduce what we saw on the books not do what was similar to what is on the books.. **What she has learnt has enabled her to think “ outside the box” and be innovative. For example she wishes to change how the grinder has been designed to less risky and be more user-friendly. Being in the rural areas is a challenge for her because of limited financial assistance. She has had opportunities to explore with what she has learnt but resources remain a challenge.**

TN3: According to the knowledge that I already have , I would open up a workshop for car service .. **the knowledge he has acquired makes him to think about opening a business and be self employed. He sees business opportunities in the skills he has acquired.**

Maz4: I can recall that our grade 12 project had to do with designing a wheelchair..this wheelchair had to have rails that enable it to ascend onto an ambulance without having to remove that person from the wheelchair..that is what we did in Mechanical Graphics and Design..this was a grade 12 task.. **Acquired knowledge enables them to design mobility equipment for the physically handicapped members of the communities. This presents plenty of business opportunities for them as they can venture out into the manufacturing industry.**

SG5: yes a lot..when we reached grade 12 that is where we had learnt how to use certain machines like the grinder confidently ..that is where we could see such opportunities ..even if our parents wouldn't be able to pay for our tertiary education we would be able to open a small business and be able to make a living for ourselves.. **they learnt how to confidently use certain tools in the workshops. This made them to see business opportunities for themselves in case they don't get a chance to proceed to the university. They would be able to open small businesses for themselves and make a living out of their acquired skills.**

ZV6: yes..i can say I learnt that you drain oil from the car and keep it and sell it so that you can make money for yourself .. **profit can be made out of waste. Sustainable living can be made out selling waste material.**

MissM7: yes I used to have such moments..(MM:...what did you have in mind?) ..as I didn't go to school in particular year but through the information that I got from high school, I realised I could do welding..even at college I did welding because it is work before you..you are even able to assist even around at home for small things ..welding also requires certain skills.. **with the acquired skills at school one can seek employment in the informal sector or open her own practice.**

MzT8: Yes I did have such ideas to such an extent that I ended up being interested in going to the mines because in the mines there are job opportunities for people who have done technical subjects..it is said there you will enrol for a learnership programme and learn mining technology and possibly end up being boilermaker..so I had those visions of being admitted there without even going to the college so that I could study courses like boilermaking, machining & fitting etc .. **there is limited exposure with regards to what learners can do with their knowledge and skills acquire during their studies. These learners have focussed on either entering the informal economy sector , being self employed , furthering their studies or being employed in low paying jobs like boilermaking or working in the mines. There are other jobs that they could enter into like urban forestry, computer graphics, small engine technology and others.**

YD9: It was in Mechanical Technology where I would find myself resolving that one day I would earn a good living with it in a form of opening a small business (workshop) because we were told about car engines an how to overhaul them, changing of shock absorbers, car service, changing of all car essentials..all these minor services and repairs that wouldn't be costly to the clients.. **what they studied gave them ideas about entrepreneurship. It seems that was one of the reasons they studied technical subjects. They wanted to acquire skills and knowledge in the automotive industry and then venture out into small business after acquiring the necessary skills and knowledge.**

Q8-MM:Do you think you were equipped and empowered to seize green economy job opportunities available in the province ? Are you able to apply the knowledge that you got from high school to green economy jobs?

AT1: Yes..in as much as I didn't work in workshops, but at the college there are few students who went to technical schools there..so even my lecturer knows that..so the lecturers even know that they can use us, who went to technical schools, as supervisors to those who didn't go to technical schools..so they use the knowledge that we acquired from our previous schools..even with the machines I can assist them because some of them are clueless on how to operate those machines and there is plenty of them so I helped by supervising them because that is what I did whilst I was at high school. **This learner was not equipped and empowered for green economy oriented jobs. What she learnt was how machines were operated generally but not specifically for jobs that were environmentally friendly.**

PN2: Yes in the rural areas peoples' cars do get irreparably damaged and people know that metals are recycled in Durban and Johannesburg where there are recycling plants for scrap metals ..but sometimes there are those that are naïve and who don't know that certain scraps and waste can generate income for them..it is usual town folks who come to the rural areas to buy cheap and recycle scrap metals and make money for them.. they help by buying these

scrap materials so that we don't get unwelcomed visitors like snakes but to keep the environment clean. **She learnt about recycling of old, waste material and how this can generate income for people especially those that collect such waste material in the rural areas. Rather than keeping such waste, communities collect and sell it to neighbouring cities like Durban , thus making money out of waste. Clearing their homesteads also protects them from snakes.**

TN3: If there was plenty of practical work then I would have been able to do such job..the only challenge is that we did a lot of theory , so it would have been ideal to know a lot of things through theory and practice..(MM:...you feel you did a lot of theory than practical work?) ..yes..(MM: so if you were to change the curriculum you would propose more practical work and less theory..?) yes..there has to more practical work ..for instance when talking about turbines they need to see what turbines are , how they work..basically they need to do practical work on turbines and how they work.. **Lack of sufficient practical work didn't equip them enough to be able to participate in such jobs. They did a lot of theory. For example they learnt about wind turbines on the book, whereas there could have been practical tasks that would have required them to construct a wind turbine.**

Maz4: Yes that is what am good at and interested in especially with jobs that have to do with mechanical engineering..so I would

SG5: Yes I would especially those that had the machines that we dealt with at school eg cutting metals, iron core, aux ascertaining..especially with artisan work where they install bridges..there are certain panels (I forgot the name) that's where we fit in ..we also do a lot of calculations..for example we calculate the forces that could be applied in certain bridges as well as determine the types of columns needed to support that bridge, determine the type of welding to be done and calculate those that will be able to withstand the forces of the bridge and determine the type of environment which will not damage the environment. **During certain practical tasks they were taught about materials to use that were environmentally friendly. Infrastructure that was erected had to be protective of the environment on which it was erected.**

ZV6: Yes I would say so..here and there..like changing of oil in machine..like I can pick up oil and plastics then you sell them and get paid..there are few I can mention.. **Recycling and income generation.**

MissM7: yes, I think I could.. (MM:...what kind of jobs do you think you could do?) Just give me 2 examples..Let us look at someone who has done electrical technology..those people are able to fix electrical appliances without going further ..when you have theory and you are able to make practical you can work on your own without even studying further .. you already have knowledge especially if you understood right from grade 10. **More practical work is important that will put into practice what they learnt in class.**

MzT8: I can because most of the times we were taught about installation of equipment just like installing solar panels..we also did such practical work which included the generations of electricity using water or using solar panels.. **He is able to enter the green economy work environment as they had been taught about installation of equipment and other related tasks.**

YD9: There are jobs that require people with technical skills but there is a huge shortage of the qualified people who have studied beyond matric..that is why when there are vacancies even people with N3 are taken because of the shortages of artisans.. **green jobs are available but**

there is shortage of educated, skilled, qualified artisans that could penetrate the green economy sector.

Q9-MM: With the environmental problems that we have like pollution, waste of water and need for recycling, what solutions did to you come up to deal with these environmental problems? Did the curriculum prepare you to deal with the environmental challenges and thus develop solutions?

AT1: I stay in an underdeveloped location and there were once burst sewage and water pipes so there was a debate challenge that was seeking solutions to end such things ..then there was an idea that there must be a machine that will be fixed onto a truck that will assemble pipes in different directions, chemicals will be put into the machine tank and then this truck will circulate around the location and these pipes will wash off the filth with the use of these machines to kill germs and bad odours and people will stop inhaling bad air..so that was the idea which came out.. **Communities where these learners come from continue to face challenges of power maintenance of infrastructure by municipalities. These include poor maintenance of stormwater drainage systems, dilapidated electricity supply stations and others. Learners have come up with ideas of assembling equipment that will deal with these challenges.**

PN2: I can say yes because when it is exam time there is plenty of photocopying that takes place and the used question papers are thrown anywhere and anyhow by the learners or they are picked up by caretakers and burnt then instead of collecting them and recycling them..so if I could I would recycle such paper because these learners write and throw these papers anywhere and pollute the environment. So if I could I would invest in recycling. **Land pollution remains one of the environmental challenges that learners are exposed to. At school there is plenty of paper that litters on the grounds, especially during exams where learners just throw question papers anywhere. So these papers could be collected and be recycled. Instead of pollution learners should be taught about recycling.**

TN3: We discussed such things during Life Orientation..As someone who stays in the rural areas, we learnt that you wouldn't just fix a car next to the river..this is because people draw water from these rivers so fixing a car or draining oil from a car next to the river increases chances of river pollution..there are also animals that will also be affected.. **Learners were taught that they shouldn't fix cars next to natural resources like dams, rivers, habitats, grazing lands and others. This because there are chances of polluting the natural habitats of living organisms and end up killing them. There will be renewed need to rehabilitate these habitats.**

Maz4: I recall learning and researching about that..what I learnt is that for people to realise that land pollution through paper and oil , they need a meeting and hold an informative workshop..we did this during one of our Life Orientation lessons..people need to be told about the dangers of pollution and how their lives will be affected..this goes hand-in-hand with burning of papers and trash during the day which is equal to air pollution.. **People need information sharing workshops that will inform them about the dangers of pollution and gains that could be made through pollution prevention and nature conservation.**

SG5: we did research on how to eliminate those ..for example to eliminate causes of water pollution..we also learnt about dealing with cars that emit smoke from the exhaust which causes air pollution ..so we were encouraged to come up with ideas that could be used for such cars so that we reduce and possibly eliminate air pollution from cars..so we were tasked to bring

about such solutions.. **As mechanical technology students they were tasked to come up with ideas that could be used to curb the emission of dangerous fumes from car exhaust pipes.**

ZV6: No..

MissM7: As community members we need to work together..cleanliness begins with you first..then you must clean your environment where you live. **Communities need to work together in order to deal with these environmental challenges especially these different forms of pollution. Community members need to exercise cleanliness right from their homes.**

MzT8: Yes we did learn about that in LO..we were even told that when we exercise it is not right to do exercises next to the road because there are cars that emit poisonous gases..you also shouldn't exercise next to where there are industries that will be releases those toxic fumes with plenty of chemicals.

YD9: Solutions to these challenges are there but we need assistance from the government..informal traders on the streets are trying to make an income for their families so how I wish that the government could put up small workshops in the locations so that these people who work on the streets can be grouped together and then they could have their own workshop..but that is nearly impossible as the government doesn't support these informal traders..i only wish for the government to assist them..identify their workplace and they work collectively.. **One of the ways the government could deal with these environmental challenges would be to address overcrowding of street vendors. The government needs to put up small workshops and stores for these people where they would be assembled and put in one workshop. However there has been little support that the government provides to these informal traders hence they make use of every space that is available to them.**

Q10-MM: Did the content of your subjects address poverty and unemployment challenges faced by the people in general? If the situation right now was different , wherein you didn't study further , do you think your high school subjects prepared you for poverty and unemployment problems?

AT1: Yes , there because in Cape Town there is plenty of work in the panelbeating sector that needs female employees because their companies are male dominated so they want to employ more female workers ..even I can also open my own panelbeating workshop because there is no automachine that I cant operate but funding remains a big challenge and those are the things that I am learning on a daily basis.

PN2: If there were more technical schools or learners had opportunities to study engineering and technology and now know what it is about, the youths would try and create job opportunities for themselves..some people do not know that you can self employ when you done engineering studies after grade 12. Even when you didn't have funding to proceed further with studies but you can work for yourself ..you can assist established car mechanics in their workshops. For example taxi door operators start from there, then you see them become mechanics through learning from an experienced mechanic..i wish ther could be exhibitions that teach learners whilst they are at junior school about technology, so that they will enrol and study further in technical high school ..this is helpful to those who wont have funds to go tertiary institutions..so after matric a person use his skills.. at home I have a grade 11 relative from a neighbouring school who is good with electronics .last year at junior school they had to design a tower. So I asked my cousin to electrify it ..sometimes people bring their electrical appliances to him for him to fix them..so I can say with technology you can generate an extra income with these projects.

TN3: We did talk about such topics in Life Orientation..(MM: ..if you can recall what is it that you talked about? .. Poverty and unemployment? ..eish I find the question hard to answer..(MM:..not all of us after matric went or would go to university or college..others will start their businesses or other will assist in workshops and garages..and many other different things)..with poverty and unemployment ,as we went to technical high school, you gain knowledge as well as ideas that inform you that you can start your own business to fight unemployment..for example with knowledge gained from Mechanical Technology you will be able to service cars..so technical schools enable you to have such ideas..for example if you have done civil technology, then that will prepare you for building jobs ..technical education gives you ideas to work with your hands through self employment and not depend on other people..

Maz4: What I can say , according to my understanding, I think poverty depends on our leaders as well as the company owners..for example I can donate clothes that I am not using to someone less fortunate and in need of them instead of burning them..(MM:..what can you do as someone who passed grade 12 but did go to tertiary as ways of fighting poverty and unemployment? ..initially I would open a small business here at home in the rural areas as means to assist my family , open vegetable gardens so that we can sell fresh vegetables..secondly , I would try to open a small repairs workshop where I would service cars through the knowledge that I attained during my studies at high school or even do some voluntary work..

SG5: They were helpful because we learnt how to start a small business..even when you start your own business the government does support such businesses through sponsoring with material and giving you funding..so our school subject have helped us because we do have ideas and background knowledge of the businesses we want to start..

ZV6: In Physics and Mechanical Technology there were small sections..i learnt about welding, doing car service and probably start business..

MissM7: yes ..(MM: ..could you please give me examples)..for example you may find someone who has been driving from wherever to wherever and the car breaks down.. I would be able to go and assist that person in trying to diagnose what is faulty and advise them what has to be done..you will see that people will reimburse you for such assistance without being on top..(MM:..so what about opening your own business?)..you can open your business and make money up until you are even employing people when the business is thriving .. the more you employ people is the more they learn..so you could end being the manager and managing them.. I am able to weld as I am currently studying about that now.. boiler making dealt with work at sea with ships at the sea, how to steer the ship, safety and how the ship functions and so forth..Welding is easy for me ..(MM ..can you also open up a business with welding?).Yes I could.

MzT8: I did have such ideas..Now that I had been taught skills at high school I had a vision of doing my own things..i can do welding, I can do car repairs..i can open a small welding company where I will do burglars or faulty cars..etc..i can also assemble a group of people and teach them about panelbeating or other related work..

YD9: Ideas have always been there but funding has always remained a challenge..there are awareness programmes for people should be exposed to..as much as it is right for people to have businesses but they need to take care of the environment too..(MM: what kind of jobs do think someone who has passed grade 12 and wasn't able to proceed to tertiary education especially those of you who studied mechanical technology?) I have noticed that in shopping malls, there is a great need of those people who are able to service those emergency generators..because of this shortage of personnel you will find that there is outsourcing of companies with personnel as far as the Western Cape and Gauteng..so it is my wish to have

such companies in the Eastern Cape..because sometimes you will find that there is one technician in Umtata who works alone without anybody else to work with..(MM:...do you think learners with matric can also be employable there?) ..one thing that happens there is that the government issues out tenders but few are able to get such jobs..so if people were to get funding then qualified people would open and register companies where they will employ people with the required skills..those with skills will teach those unskilled ones..skills that we learnt at high school and also those with specialised skills for fluidity purposes..this will done so that there can be more companies that are opened in different parts of the country..

MM: Ok, thank you for your valuable contribution.

Annexure M



2 August 2019

Mcebisi Mkaza

Review Reference: 2019-0204-600

Email: g9640472@campus.ru.ac.za

Dear Mcebisi Mkaza

Re: The extent to which Grade 12 Mechanical Technology (MT) curriculum practices prepare learners to participate in the green economy

Principal Investigator: Prof Eureta Rosenberg

Collaborators: Mr. Mcebisi Mkaza,

This letter confirms that the above research proposal has been reviewed and **APPROVED** by the Rhodes University Ethical Standards Committee (RUESC) – Human Ethics (HE) sub-committee.

Approval has been granted for 1 year. An annual progress report will be required in order to renew approval for an additional period. You will receive an email notifying when the annual report is due.

Please ensure that the ethical standards committee is notified should any substantive change(s) be made, for whatever reason, during the research process. This includes changes in investigators. Please also ensure that a brief report is submitted to the ethics committee on completion of the research. The purpose of this report is to indicate whether the research was conducted successfully, if any aspects could not be completed, or if any problems arose that the ethical standards committee should be aware of. If a thesis or dissertation arising from this research is submitted to the library's electronic theses and dissertations (ETD) repository, please notify the committee of the date of submission and/or any reference or cataloging number allocated. Sincerely

A handwritten signature in black ink, which appears to read "J Dames".

Prof Joanna Dames

Chair: Human Ethics sub-committee, RUESC- HE

Annexure N: Green economy content in the curriculum practices of Engineering Graphics & Design (EGD)

ANALYTICAL DIMENSIONS	EXTRACT	Emerging green economy related themes	SOURCE	ANNEXURE K
SAYINGS	<ul style="list-style-type: none"> • I don't remember having a chapter that specifically deals with green economy • There are sections in other trades that inform the learners about selling waste or destroying it in designated areas • A learner could have an idea of designing something useful from the trash 		MrV-1	K
DOINGS	<ul style="list-style-type: none"> • There is a space here at school where we burn waste • Learners will pen down the idea of a tool for trash recycling • After Practical Assessment Tasks(PAT) learners need to tidy up and consider the safety of those that will follow after them. Scrap materials left will be burnt and useful ones will be stored or recycled and sold. • Learners are sometimes hired by companies that require someone skilled who is going to design or draw a lot of devices that will generate electricity through solar energy. 		MrV-1	

RELATINGS	<ul style="list-style-type: none"> Learners will collectively, as a group, plan on how to design something that will enable material recycling 		MrV-1	
Cultural-discursive arrangements	In the trades , there is a chapter that is called Good housekeeping that deals keeping the workshops clean after the practical. There are marks allocated for good house keeping.			

Analytical Memo 4-Site 01

Green economy content in the curriculum practices of Mechanical Technology

Analytical Dimesnions	Extract	Emerging green economy related themes	Source/s	Annexures
SAYINGS	<ul style="list-style-type: none"> I don't know much about it but the only thing I understand when it comes to the green economy is that there is a part of recycling within it There is a chapter that deals with metals that undergo heat treatment. After that waste material is recycled. Learners understand that metals are reusable and recyclable. We focus on recycling Those learners who cannot further their studies at tertiary institutions would have acquired skills to sustain them so that they can start their businesses. If that fails, they can go for job shadowing at a nearby car repairers garage. This is done to 		MrMg-3	

	acquire more skills at her speciality,			
DOINGS	<ul style="list-style-type: none"> • We work with metals that are recyclable • Waste material shouldn't be disposed off but should be recycled • Cut-offs which are scraps are stored. When there is plenty of them we take them to a recycling plant. • We make profit from selling these scraps 		MrMg-3	
RELATINGS				
Cultural-Discursive Arrangements	<ul style="list-style-type: none"> • In a workshop there are rules and regulations. For example you don't play around with tools in the workshop and you need to clean the space you have been working on. Housekeeping rules state that after practical work , waste materials called cut-offs need to be collected and safely stored . • Workshops must be well ventilated as there are fumes or gases that are released during cutting, grinding and welding 			

Analytical Memo 7 Site 01

Green economy content in the curriculum practices of English First Additional Language

Analytical Dimensions	Extract	Emerging green economy related themes	Source	Annexure
SAYINGS	<ul style="list-style-type: none">• Green economy content is where we are talking about waste management, water harvesting, water pollution and recycling in the subject• Green economy is taught as a topic for discussion in the activities like essay writing or research about it and hold debates on it		MsB-7	
DOINGS	<ul style="list-style-type: none">• Learners are given topics to research on green economy and do oral presentations of their research in class or hold debate sessions in class. Sometimes they write investigative reports on their findings• Within the contents of the subjects learners are taught about pollution prevention and water preservation.			

Analytical Memo 10 site 01

Green economy content in the curriculum practices of Life Orientation

Analytical Dimensions	Extract	Emerging green economy themes	Source/s	Annexures
SAYINGS	<ul style="list-style-type: none"> • In one of the chapters, there is a topic called Social and Environmental responsibilities where we talk about waste management. We talk about how to dispose waste off. • We learn about the harmful effects of residing next to a place that emits poisonous gases • We learn about natural disasters like floods that are caused by human irresponsible actions towards the environment • As said before , it is mentioned in some sections of the course 		MrsM-10	
DOINGS	<ul style="list-style-type: none"> • Learners are given research work for 5 weeks where they have to investigate what happens to waste products in their communities as well as dangerous effects they have on humans. 			
RELATINGS				
Cultural-discursive arrangements	Within the LO prescribed curriculum there is a chapter where learners are taught Social and Environmental responsibilities		MrsM-10	

Analytical memo 12 Site 01

Green economy content in the curriculum practices of Physical Sciences

Analytical Dimensions	Extract	Emerging green economy related themes	Sources	Annexures
SAYINGS	<ul style="list-style-type: none">• Green economy helps with the environment through reduction of pollution, creates job opportunities for unemployed people because we talk about recycling and water harvesting in green economy related matters			
DOINGS	<ul style="list-style-type: none">• Learners use DC-AC generators when doing projects in the lab. These generators generate energy using wind, water and the sun.		MrMar-12	

The following analytical memos were used to analyse learners' responses to the second subquestion: What are the sayings, doings and relatings relating to the green economy content in the curriculum practices of grade 12 Mechanical Technology stream? This subquestion has been further explored during the interviews into the following questions:

- (1) During your studies have you ever been taught anything about the green economy?
- (2) Were there any projects, tasks that you did in the labs/workshops that were linked to the green economy or jobs?
- (3) Do you think you were equipped and empowered to seize green economy job opportunities available in the province?
- (4) Did the curriculum prepare you to develop solutions to the environmental challenges?

Analytical memo 1 Site 01

GREEN ECONOMY CONTENT

Analytical Dimensions	EXTRACT RESPONDING TO THE QUESTION 1	Emerging green economy related themes	Sources	Annexures
SAYINGS- theories, ideas and understanding of the green economy.	<ul style="list-style-type: none"> I can recall learning about recycling. I learnt about three types of recycling: First type being plastic recycling, second type being steel recycling and the third one being waste recycling 		Maz4	
DOINGS- Teacher and learner behavior and actions with regards to green economy related content	<ul style="list-style-type: none"> Yes we were taught about it especially those who were in the Mechanical Technology stream. We dwelled a lot on recycling We learnt that after practicals, the remaining cut-offs/ scraps had to be collected, put in a container, smear a chemical called Cast Iron so that these pieces change to their original colour and be recycleable. When disassembling cars or during engine overhauls, we learnt we were taught to be very careful of oil leaks and other fluids. There were designated areas for these practicals so that leaks would be contained in such spaces. 		AT1 PN2	

	<ul style="list-style-type: none"> • When changing car oil, we would drain it into a container so that it can be returned to the oil refinery for rejuvenation and reuse. Scrap metals that are leftovers were taken back to the steel refineries for recycling and reuse. • In the workshops, we would cut some material and do burglars and left piece left unused were sent out for recycling. Waste wasn't thrown away randomly as we had to protect the environment. • I remember talking a bit about these topics in Physical Sciences as well as Life Orientation. We learnt about saving water and paper. We learnt about oil storage after use so that it can be resold for recycling . • We once learnt about recycling and keeping our environment clean. • We were taught not to let oil and other fluids to drip on the floor during our practicals. Used oil is taken for recycling where expired oil substances are removed and some chemicals are added to make new oil. Oil scrap metals are also gather and packed away for recycling 		<p>TN3</p> <p>SG5</p> <p>ZV6</p> <p>MissM7</p> <p>MzT8</p>	
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<p>RELATINGS-</p> <p>This aspect deals with how teachers relate to learners on green economy content.</p>	<ul style="list-style-type: none"> During our practicals we had to do group work because of insufficient resources 		YD9	

Analytical memo 2 Site 01

GREEN ECONOMY ORIENTED PROJECTS/TASKS

Analytical Dimensions	EXTRACT RESPONDING TO QUESTION 2	Emerging green economy related themes	Sources	Annexures
SAYINGS	<ul style="list-style-type: none"> • We learnt about waste management 		TN3	
DOINGS	<ul style="list-style-type: none"> • During our Practical Assessment Tasks (PAT) we were taught not to leave steel crumbs on the floor but to drop them in the recycling container. • When were changing oil from engines during PAT we were taught to drain it into special waste containers. 		AT1	
RELATINGS	<p>Our teacher split us into groups that worked in the labs as we were tasked to explain how could we protect the environment. The task was about projects that will suggest how could people lessen the emission of poisonous gases that cause ozone layer depletion and global warming.</p>			

CULTURAL-DISCURSIVE ARRANGEMENTS	<ul style="list-style-type: none"> • There were Safety regulations that we had to follow about cleanliness and tidiness in the workshops. There were rules on protective gear that one had to wear from head to toe. 		MissM7	
MATERIAL-DISCURSIVE ARRANGEMENT-	The learners were unable to do some tasks due to insufficient equipment and inadequate financial resources		YD9	

Analytical memo 3 Site 01

LEARNER PREPARATION AND PREPAREDNESS TO SEIZE GREEN ECONOMY JOBS

	EXTRACT RESPONDING TO QUESTION 3	Emerging green economy related themes	Sources	Annexures
SAYINGS	<ul style="list-style-type: none"> She learnt about of generating income through recycling and selling waste material. 		PN2	
DOINGS	<ul style="list-style-type: none"> A lot of theory was taught but there was little practical work. There has to be plenty of practical work . For example if a lesson on that particular subject talks solar or wind energy equipment like turbines then learners need see turbine and study how it works. During practical sessions the learners were taught about materials to use that were environmentally friendly. Most of the times we learnt about installation of equipment like solar panels. We also did practical work which includes generation of electricity using water or solar panels. 		TN3 SG5 MzT8	
RELATINGS				
Cultural-Discursive arrangements	<ul style="list-style-type: none"> If there was plenty of practical work then I would have been able to do such jobs. The prescribed syllabus 			

Material-Economic arrangements	<p>made them to do a lot of theory.</p> <ul style="list-style-type: none"> • Green jobs are available but there is shortage of educated, skilled, qualified artisans that could penetrate the green economy sector. 			
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Analytical memo 4 Site 01

SOLUTIONS TO ENVIRONMENTAL CHALLENGES

Analytical Dimensions	Extract responding to question 4	Emerging green economy related themes	Sources	Annexures
SAYINGS				
DOINGS	<ul style="list-style-type: none"> • In my community we have problems of burst water and sewage pipes that occur frequently. Community members met and there were suggestions that there must be a device or machine that will be fixed onto a water truck. This machine will be loaded with chemicals and this truck will circulate around the location steam spraying filth off the streets. • Papers that are thrown around schools campus during exam time could be taken for recycling. • Learners were taught that they should avoid fixing cars next to natural habitats like dams, rivers, grazing land and others. Hazardous spillage of oil and other chemical may pollute these natural habitats of living organisms and end up killing them. • As Mechanical Technology learners we were once tasked to to come up with ideas that could be used to curb the emission of dangerous fumes from the car exhaust pipes. 		<p>AT1</p> <p>PN2</p> <p>TN3</p> <p>SG5</p> <p>YD9</p>	

	<ul style="list-style-type: none"> • One of the ways government could deal with these environmental challenges would be to address overcrowding of street vendors. • The government needs to put up small workshops and stores for the street community where they will be assembled in one of these halls or workshops. 			
RELATINGS	<p>Communities need to come together as groups and organize information-sharing workshops that will inform people about the dangers of pollution and gains that could be made through pollution prevention and nature reservation.</p> <ul style="list-style-type: none"> • Communities need to work together in order to deal with these environmental challenges especially different forms of pollution. 		MissM7	Maz4

The following set of analytical memos belongs to participants from Site 02.

Analytical Memo 2- Site 02

Green economy content in the curriculum practices of Engineering Graphics & Design (EGD)

Analytical Dimensions	Extract	Emerging green economy related themes	Sources	Annexures
SAYINGS	<ul style="list-style-type: none"> When you are talking about green economy I think you talk about agriculture when you plant.it's about seeds and plants where you use soil 			MrH-2
DOINGS	<ul style="list-style-type: none"> When you plant something In certain communities especially in rural areas you may find that there are scavenging dogs that spill garbage all over people's yards. As EGD people it is our duty to design a garbage bin to store waste and keep it from dogs. Learners do a project on this for the whole year where they research and design mechanisms to fight pollution. Learners come up with plan and design and make a living through selling their designs They can design the green house and 			MrH-2

	<p>waterbins that are used to store water when it is raining</p> <ul style="list-style-type: none"> • When there are infrastructural developments, the EGD learners are usually called to determine to suitability of that land for any work to be done. Environmental protection is a priority in their drawing. 			
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Analytical Memo 3- Site 02

Green economy content in the curriculum practices of Mechanical Technology

Analytical Dimensions	Extract	Emerging green economy related themes	Sources	Annexures
SAYINGS	<ul style="list-style-type: none"> • yes I do cover green economy • the safety of the environment is very important • There is a chapter on Safety which addresses the process of recycling and reuse a lot. Learners are taught not to harm the environment. • Waste material could be dangerous over time . For example some objects are made of flammable material which explodes 			MrZ-4

	<p>over time if its buried under hot surfaces</p> <ul style="list-style-type: none"> • Mechanical Technology doesn't specify anything with regards to preparing learners to participate in the green economy 			
DOINGS	<ul style="list-style-type: none"> • In the workshops as we work with cars in terms of oil that we use on these cars • we cut materials and we will be having off cuts • During practicals we make use of testers that gauge the gases level in a newly repaired car so that it doesn't release toxic gases that will pollute the air • We also check for oil and petrol so that they don't spill onto the environment but must be well stored in their tanks in the car • Liquid material like used oil is taken to the recycling plants where it is rejuvenated. • Small scraps of metal that remain are collected and given to nearby recycling plants 			MrZ-4
RELATINGS				MrZ-4
Cultural-Discursive Arrangements	<ul style="list-style-type: none"> • According to the Occupational Health and safety act material should be reused if its in good 			MrZ-4

	<p>condition and also be recycled.</p> <ul style="list-style-type: none"> • In our curriculum we do have a chapter which is called safety • There is a chapter which talks about gas analysers 			
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Analytical Memo 5 Site 02

Green economy content in the curriculum practices of Technical Mathematics

Analytical dimensions	Extract	Emerging green economy related themes	Sources	Annexures
SAYINGS	<ul style="list-style-type: none"> It was back at high school where I heard about it. In recent years I have not heard about it and it was not part of the courses I studied after matric 			MrF-5
DOINGS				
RELATINGS				
Cultural-Discursive Arrangements	<ul style="list-style-type: none"> The nature and content of Technical Mathematics does not allow green economy content to be part of the curriculum 			
Comment/s:	<ul style="list-style-type: none"> They did green economy related topics in Agriculture whilst at school. They learnt about which plant to grow in certain areas because of favourable weather conditions for them. 			

Analytical Memo 6 Site 02

Green economy content in the curriculum practices of English First Additional Language

Analytical dimensions	Extract	Emerging green economy related themes	Sources	Annexures
SAYINGS	<ul style="list-style-type: none"> I know that in my street there is a business called XXX Waste where people collect recyclable material In class learners are encouraged to provide ideas and suggestions on how to keep the town clean Through their ideas even business ventures become possible as they exchange ideas on how business can be started 			MrK-6
DOINGS	<ul style="list-style-type: none"> People and learners will collect plastics, bottles, papers and take them to this company and sell them there These people clean the streets and leave the environment tidy. Learners will be taught essay or summary writing skills but will be reading from a passage with green economy content. Sometimes they are tasked to write a formal letter to the local municipality and raise their health concerns They learn that someone is able to participate in the green economy through collecting papers, thus 			Mr K-6

	<p>helping you financially as well as benefitting the environment. This will also encourage them to come up with their own ideas or ways of making a living out of the green economy</p> <ul style="list-style-type: none"> • 			
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Analytical Memo 8 site 02

Green economy content in the curriculum practices of Physical Sciences

Analytical Dimensions	Extract	Emerging green economy related themed	Sources	Annexures
SAYINGS	<ul style="list-style-type: none"> In Physical Sciences we heard about that about that but I don't think the learners are aware of that. For example, India has been having this recycling process for more than two decades South Africa has just started recently. Even here we have just started collecting papers, plastics, bottles.so the learners are not aware of that. .However green economy is not prescribed as content for Physical Sciences. It is not taught but related topics like water pollution are mentioned in passing. Out of the prescribed curriculum , I told the learners about a nearby scrap yard where metal scraps are dumped. Subsequently they are exported to other countries for recycling and returned to South Africa for manufacturing purposes 			MrsD-8
DOINGS	<ul style="list-style-type: none"> There are extra-curricular projects that learners where learners participate in like Eskom Expo. This is where there they design and construct projects with green economy related content like water 			MrsD-8

	purification, wind, solar energy devices			
Cultural-Discursive Arrangements	The Physical Sciences curriculum needs to be reviewed so as to introduce green economy related concepts like recycling because when learners reach senior classes they know nothing about these important concepts			

Analytical Memo 9 site 02

Green economy content in the curriculum practices of Mathematics

	EXTRACT	SOURCE
SAYINGS	There is no green economy content in Mathematics	Mr Nom-9

ANALYTICAL MEMO 11 SITE 2

Green economy content in the curriculum practices of Life Orientation

Analytical dimensions	Extract	Emerging green economy related themes	Sources	Annexures
SAYINGS	<ul style="list-style-type: none"> We have a chapter in term 3 work schedule that promotes cleanliness of the body and the environment. This is because pollution is the major area of concern. In the third term there is a chapter where the learners are required to give examples of the green economy according to their understanding. We once talked about recycling with the learners and they were asked to give examples of the recycling process. Some mentioned the recycling of scrap 			NG-11

	metals and others mentioned that manufacturing and production companies need to protect the environment during these processes			
DOINGS	<ul style="list-style-type: none"> If one has a factory, waste material must be dumped on clearly marked dumping zones. In class exercises regards green economy, learners are sometimes required to give examples of green economy and do research on them. 			NG-11
RELATINGS				
Cultural-Discursive arrangements	<ul style="list-style-type: none"> Green economy related topic is found in the grade term 3 subject plan. There is a chapter on cleanliness. 			NG-11
Socio-Political Arrangements	<ul style="list-style-type: none"> Certain municipality laws state that manufacturing companies must be located far from residential areas so that people may not be affected by respiratory illnesses caused by gases from these factories. It is stated by law that health centres must construct dumping sites for their hazardous waste material far from reach of children 			

Annexure O

FOCUS GROUP TRANSCRIPT

IKWEZI TECHNICAL SKILLS CENTRE LEARNERS (SITE 02)

The researcher started off by explaining to the participants why he had called them. He explained to the participants that he is doing research on what is referred to as green economy. However, he will explain further to them what it is about. He told the students that he would like them to go through and sign the consent forms after both parties have agreed to the interviews. He enquired the total number of learners registered at their school for Mechanical Technology and they responded by saying they are seven matriculants in total enrolled under the Mechanical technology stream. He informed the participants that the research is voluntary and is grateful that they have agreed to partake. The researcher informed them that he is researching about the green economy. When explaining green economy to the man on the street we talk about the use of solar energy, waste management, water harvesting and so forth. In other words how do we keep our environment clean? As they are doing Mechanical technology, Languages, Life Orientation, Maths/Technical Maths, Sciences, do they ever talk about green economy in these subjects? He requested to record the proceedings to accurately capture their responses. He also promised that he will find time and revert to these learners for member checking purposes and validity concerns. He explained the purpose of the consent form and its content and the purpose of these consent forms. Language of communication is any of the official languages that they are comfortable with. They are encouraged to participate without any reservations in this discussion. The interview schedule is similar to the one administered to the individual participants earlier but some questions have been left out.

Q1-MM: In grade 10 you decided that you were not going to pursue academic stream where subjects like Life Sciences, Geography are done. What made you not to be interested in subjects like Life Sciences, Geography and others? Don't mention your names but rather respond spontaneously. When responding, each participant will give his reasons and explanations. Why did you choose technical subjects?

SK 1: We chose technical subjects because they have something to do with technical education

Q2-MM: What exactly attracted you to technical subjects?

SK2: Personally I chose technical education/course because of my interest in Mechanical Technology as that is what I want to study further.

Q3-MM: You want to pursue Mechanical Engineering after grade 12 or what.

SK 2: Yes that was the dream

Q4-MM: You saw this as a chance for you to build up your career aspirations by laying a foundation first

SK 3: My inspiration goes way back and also in how I grew up. Like when I was a child I was interested in things that had to do with cars. So later on in life I spoke with my mother about doing engineering. I told her that I felt comfortable with it and I'm going for it as I am passionate about it. I want to study it as it had to do with what I am passionate about. In the long run it turned out that at school we are not doing all the components of Mechanical technology (Automotive, welding & metal work and Fitting & Turning). We are doing Practical Assessment Tasks (PAT) that focus only on welding. At school we are not doing automotive which was something that kind of disappointed me because that is not what I wanted. I am someone who is more into cars.

Q5-MM: So you were more interested in things that have to do with cars. More than welding...so now you are doing welding. Is welding the only component of your PAT?

SK 3: Yes so far we have done welding and also when I have data and I log on to the internet especially on Youtube and watching videos, I got to a point whereby I learnt, joined and accepted that now I am going to be doing welding and welding may take me somewhere or maybe to what I want to do that has to do with cars. So when I am watching these videos and there are these companies with cool cars like Siemens that manufacture these pretty cool cars that run very fast. So it was disappointing but I realised I am stuck with welding...otherwise my interest in technical subjects was sparked by the fact that I wished one day I would eventually do what I always wanted to do.

Q6-MM: and you brother? Why did you choose to do technical subjects? I mean what attracted you to these technical subjects?

SK 4: (a learner who is experiencing speech and hearing impairment) Technical subjects will enable me to do "piece jobs" like fixing doors..and other small things that need to be taken care of.

Q7-MM: what about cars? Were you not interested in them?

SK 4: No I was not interested in cars.

Q8-MM:...and you brother?

SK 5: For me Sir, I grew up interested in Engineering so that's why I chose Technical studies. In the Engineering field I am not interested in car technology but I specialise in welding and metal works so that's why I chose welding in my trade.

Q9-MM: OK.now let us talk about green economy topics. I want to explain to you guys what are talking about in the last question, right at the end. We talk about renewable energy, renewable energy projects like recycling, waste management, water harvesting..when we talk about renewable energy we are talking of the use of the wind. For example we sometimes see wind turbines (they all agree) the use of the sun as the source of energy that we refer to as solar energy and then we talk about recycling where we recycle papers. For example in your workshops you do have "cut-offs" after welding.. that is all the process of recycling because those "cut-offs" are recycled..then waste management deals with what is done with those "cut-offs" after welding..then water

harvesting..for instance now it as raining as we speak.. In the rural areas there are those huge buckets/drums that collect rain water..thats water harvesting..in some places you will find that as the water flows downwards it will be gathered in a dam ..then sustainable economic practices refer to what you were saying ..when you were saying you want to specialise in welding so that you can generate an income and make a living for yourself..now when we flip over and look at our questions on the next page when you think about LO, IsiXhosa, English are there topics that have to do with what we spoke about above..it can be Life Orientation, Languages, Maths and Technical Maths, Science or Technical Science.. can you recall where you talked about recycling, renewable energy, waste management.?

SK 1: As far as I can recall Sir, I remember on this other time we had a topic of discussion in Life Orientation whereby you talk about yourself as an individual, effort or role that you play as an individual in your community. so we would discuss such topics. For example we would discuss about how to maintain your street and that certain society where you live. you need to abide by the rules and regulations that are there. At a certain time or at a certain period you will gather as the community, hold meetings and plan on how to keep your environment clean or you may form an organisation that will help the community you live in. Kids today use drugs so such initiatives may help to overcome such challenges and help them in many ways. For example the community may form such organisation so that people can clean and not litter anywhere but pick up trash and dispose them in designated tanks or drums and this will make a way of a clean community.

SK 2: In LO we learn about recycling and how to take care of the environment .what good cause comes out of taking care of the environment ..that's a good cause that could provide jobs for the people, to clean and pay those people involved in cleaning the neighbourhood.

SK 3,4.5. : our responses will be similar to what he said

Q10-MM: Did you have projects or tasks that you did in the labs that were linked to green economy activities that you can remember of ? Maybe in Mechanical Technology, EGD.. not necessarily in the trades but also in other subjects? Do you have Practical Assessment Tasks (P.A.T.) that taught you how to take care of the environment..that teach you what are you supposed to do in order to keep your workshops neat and tidy?

SK 01: In Mechanical Technology we learnt that we should not dump gases anywhere and anyhow because that will pollute that certain area ..we learnt to keep the area we are working in clean and not pollute the area you are working in and it must be well-ventilated.

SK 02: During our practicals, when we arrived at the workshops we had to ensure that they are user-friendly and we were not allowed to leave the workshop untidy.It had to be clean as you work by rule..there were pieces “ cut-offs/left overs” that remained that should be dumped..so at times you would leave on a small piece that you would use for patching. Our teacher used to tell us not to waste the material but we should find use for the waste material. For example in the workshop there is a machine called the guillotine to cut metal pieces..so whenever you needed pieces you would use that machines for those small pieces you needed.

So in essence, you are not wasting material but rather re-using what you already have..those pieces that have been left out.

Q11-MM: (...so basically that is recycling?)

Speakers all agree

Q12-MM: Are there any additions that you wish to make gents? Any other additions that you are thinking of on the issue of recycling? OK..so what about the school in general? How do you ensure that the school is taken care by yourselves? Not necessarily as people who are working with the trades but generally how do you take care of the school?

SK 01: To answer your question, I would say for me personally in a way it comes with discipline because in our school there are helpers who clean our school everyday ..those helpers ensure that the school is clean, there are no papers and there are no leaking taps..so even you as an observant person you look at what they do and you also learn that you are not going to eat and throw litter anyhow. Even when eating sometimes you forget and litter but you recall that it's the elders who clean and then you pick up whatever refuse is there, even if at times you forget but you recall from memory that the helpers ensure that the school is clean at all times so you cannot just litter anywhere.

SK 02: To add on what he just said, those people are older than us so you have to pay respect to them..even if they clean the school this reminds us that you cannot just litter and expect them to pick it up from you..so they cant clean after us all the time because we know that you have to look after the environment yourself especially for us at school..we should be proud of our school and how it is depends on us..so this teaches you respect , how to take care of yourself as well as the school.

Q13-MM: Gents? (Speaker 3,4, 5,???)

They chuckled and were unwilling to make any additions

Q14-MM: Looking at the seven subjects that you have done ..am going to say you have done because now we have come to the end of the year and you will be writing exams soon, do you think that what you have learnt for the past three years at your school ...do you think those subjects have prepared you to make a living for yourselves? Do you think you can stand on your own and do small projects that will enable you to make a living?

SK 01: Yes you can design things of your own..you can produce your own idea..

Q15-MM: (interrupts) maybe what kind of things? What things have you learnt about and you thought to yourself these you can do on your own ?

SK 01: You can design things like a gate (Trellidor type)..braaing stands.. money safe..

Q16-MM: (interjecting..) which project did you do this year in mechanical technology?

SK 01 and 02: Braaing stand and the chimney

Q17-MM: So you have learnt ..

SK 02: Since I have done Mechanical technology and now being in a position to use the knowledge that I have this could lead to me opening a business. Subjects like LO teach you that you can start a business with what you are good at .As for me, I would like to look at myself as an upcoming fashion designer so LO taught me that what you are good at could actually be business like..you could be welding gates like what this guy said..he could start up his own small business and weld people's gates and make braaing stands People start businesses with what you are good at. Uhm out of interest I am an upcoming fashion designer and I design clothes for certain brands and stuff..

Q18-MM: Through what you have learnt at your school, can you make a living for yourself? As a current learner at your school, is there a skill that you have that you can use to make a living for yourself at school?

SK 5: (Hard-of-hearing learner) ...(silent..thinking)

Q19-MM: As it is, you did welding ..

SK 5: Yes I can..

Q20-MM: After matric, what things do you think you can do?

Q21-MM: gates?? Braaing stands?? Burglar proofs

SK 5: burglar proofs

Q22-MM: Let us say next year, not all of you will go to tertiary institutions ..so what happens? When you have not gone to the tertiary, how will these subjects assist you especially what you have learnt over the past three years.. On your minds, what do you think will happen? Is there something that you think will enable you to make a living for yourself next year even if you don't go to tertiary? How will you make a living for yourself next year as someone who did Mechanical Technology or these subjects that you have studied?

SK 03: For me Sir, again with me I can become a tutor for EGD since I am good at it so I can charge people a certain amount for me to teach them some topics in EGD..Alternatively, with Mechanical Technology I could ask/ apply for tenders where I can help somebody with the gate or weld a certain piece for somebody's braaing stand or chimney..

SK 04: Weeell, to add onto what he is saying, I believe that there are things that we have been taught at the school.After we had done PAT that we did where we had to construct a braaing stand, our teacher told us that our braaing stands are in demand. Apparently he took photos of them and posted them online and then he received orders .So our teachers and people who had access to those pictures were making requests to purchase those braaing stands..so that on its own opened an eye in me that actually as a person this is actually a way in which as a human being, one can make a living..you can make a living out of something that you learnt.

Q23-MM: So is that the route that you would take next year in the event that you don't go for tertiary studies for whatever reason..would you consider that route?

SK 4: (Chuckles) In my case I would say it would be the last option to make quick bucks..i don't see myself doing that (all laugh)

Q24-MM: So we are all going to tertiary next year. Right? (all laugh) So even if you go to tertiary sometimes you are able to study and generate small income for yourself at your spare time.... do you think you have enough skills that will enable you whilst studying to be able to construct objects for willing buyers on the side

SK 3: I could open a workshop regardless of how small it is ..

Q25-MM: (..even at home..or whatever space you are able to rent because of the skill that you have acquired)

SK 4: If it happens that you want to do something at your spare time, the reason for me it would be the last thing ever that I do is because God has blessed me with a lot of talent so with the other hustles. I am a rapper. I do music related projects during my sparetime. for me that is my talent...(rest of what he says is not related to the question) ...with the conversations that I normally have with my mother she always tells me that school is important..For example if one is an athlete or soccer players you may be injured in the next six months and your career will be over.so if you have school backing you up then you can say I did that at school and this is my way out. So my mother used to say to me education is important because you might have an injury whilst playing and that will disable you from pursuing your goals further.. If you have school then you can always fall back onto what you learnt at school.

SK 3: Speaking about what he is saying..as his mom says he should focus on his school, I come from a family which emphasises that education is the key but not the only key..so with me, my mom also knows that I do like rapping..I do rapping with this guy..so I rap..I design a lot of things..so after school I won't say I would use that to make a lot of extra money I don't want to say I wont use the skills that I got from school but I prefer to use my own skills. Those skills are about what I like doing..what I was taught.

Q26-MM: In what you have learnt at school, do you think that has opened your mind to how can you develop solutions to environmental problems? When we look around we have a problem with pollution..there is pollution around..there is scarcity of water..there is unemployment..lots of environmental problems. Do you think what you have learnt in all the 7 subjects has enabled you to develop solutions..eg how can I deal with land or air pollution..how can I deal with renewable energy and all of those things?

SK 4: Oh well yes because in LO and in English there is always these case scenarios whereby in this environment they have problems with water and this is the reason why it is like that because their dams are dirty ..in that specific environment that has dirty dams you could provide them with ways in to provide clean water and provide ways to deal with pollution..provide them with chemicals for pollution..create dumping site for paper and plastics so that it doesn't pollute the area around..

Q27-MM: (..and you gents?) referring to the other participants

SK 1,2, 3, and 5: It's all the same.

Q28-MM: When you look at the 7 subjects that you have studied, how can you address poverty and unemployment in these subjects? This goes back to the issue of skills in the sense that you would say that you have learnt something at school regardless of what it is, so now how do I make sure that I do not become poor or how do I ensure that we do not become a statistic of people who are poor and unemployed?

SK 4: Coming back to LO, LO tells you that education is the key but not the only key. For instance you get people out there who have studied and have got their degrees but still are sitting at home doing nothing only because they don't have a certain place to get a job or they are not passionate enough to be skilled to make a living out of what their skill is so with me ..i think that you could literally make a living out of the skill that you have. For example there is this guy who is a dancer and he could make a living out of dancing for gigs..he could make money out of that. Education is not the key in our days.

Q29-MM: But coming back to what we have learnt..coming back to what you were saying you welded a project of braaing stands..so lets say if you could have capital that will enable you to hire (rent) a space in places like Transido where you can make a lot of those braaing stands and can you see that is the way you can make a living for yourself?

SK 4: Yes that is the way..

SK 5: Yeah I mean if I could have that kind of money I would..with regards to what our teacher has said, this has shown me that the braaing stands project seems as if it is in demand..he even told us one time that a lady from Umtata wanted a braaing stand so badly that she went to East London for it and he told her that the transition piece on its own that is used to assemble the braaing stand will cost her about R3000-R5000..so that is hectic if that is the cost of a single part..some saw our projects on Facebook, called our teacher and she asked for people who could make such a braaing stand for her. She also saw this as an opportunity to make a living..Actually , these are just small projects that you can make within a week and make a living out of them so that on its own shows that if you wont proceed to tertiary studies or life doesn't go the way you think but at least school has taught us that with all the skills that we have taught , you can make a living out of them but then as a human being you also need to have a vision. You cant keep telling people that you have this or that...not using what you have you are similar to someone who is dead because you will starve without using your talents.

Q30-MM: Is there anyone of you who is interested in taking a gap year next year and make use of the skills that he has acquired? Did you ever think about that?

All participants: NO

Q31-MM: I mean the skill acquired through technical education.

SK 5: Yeah in my case

Q32-MM: (Interrupting) Like as you said..braaing stands as a project..maybe designing Trellidor-type of burglars, welding stands or something.

SK 5: In my case am not into welding a lot ..my passion has a lot to deal with automotive (cars) so this other period in life I think I will take a gap year because at school I was interested

in things that have to do with cars..it might be engine overhauling and re-assembling it or being taught about the basics of the automotive industry itself.. so I thought I will take a gap year and do research by myself because my interest when I went there so that when maybe I go to college or at varsity there could be a course whereby it deal with designing because I love designing..like at times I would just sketch things and at times if I see a certain car I would say this car is dope but I would sketch some imaginary additions to it. So I would go as far as having a dream of designing this car..as watching videos from YouTube trying to find out what are the basics of designing a car. That helped me a lot because now when I walk next to a car I know that a certain dynamic is for this car, this is the use and all that.

Q33-MM: ..Gents? Even if you are at college or university.at your spare time have you even thought of using your skills as he says..maybe during holidays you can make burglar gates

SK 2: I would probably look for a piece job in the workshops so that I could make some extra cash.

Q34-MM: What skills did you learnt at school that will enable you to make a living for yourself?

MM: Ok gents that's a wrap. thank you very much..you helped me a lot.. Thank you so much for your time ..that is the information that I wanted from this interview.

Annexure P

SECTION 1: INTRODUCTION TO THE CURRICULUM AND ASSESSMENT POLICY STATEMENT

1.1 Background

The National Curriculum Statement Grades R-12 (NCS) stipulates policy on curriculum and assessment in the schooling sector.

To improve implementation, the National Curriculum Statement was amended, with the amendments coming into effect in January 2012. A single comprehensive Curriculum and Assessment Policy document was developed for each subject to replace Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R-12.

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1.2 Overview

(a) The National Curriculum Statement Grades R-12 (January 2012) represents a policy statement for learning and teaching in South African schools and comprises the following:

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- (i) Curriculum and Assessment Policy Statements for each approved school subject;
- (ii) The policy document, National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12; and
- (iii) The policy document, National Protocol for Assessment Grades R-12 (January 2012).

(b) The National Curriculum Statement Grades R-12 (January 2012) replaces the two current national curricula statements, namely the

- (i) Revised National Curriculum Statement Grades R-9, Government Gazette No. 23406 of 31 May 2002, and
- (ii) National Curriculum Statement Grades 10-12 Government Gazettes, No. 25545 of 6 October 2003 and No. 27594 of 17 May 2005.

(c) The national curriculum statements contemplated in subparagraphs b(i) and (ii) comprise the following policy documents which will be incrementally repealed by the National Curriculum Statement Grades R-12 (January 2012) during the period 2012-2014:

The Learning Area/Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines for Grades R-9 and Grades 10-12;

- (ii) The policy document, National Policy on assessment and qualifications for schools in the General Education and Training Band, promulgated in Government Notice No. 124 in Government Gazette No. 29626 of 12 February 2007;
- (iii) The policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), promulgated in Government Gazette No. 27819 of 20 July 2005;
- (iv) The policy document, An addendum to the policy document, the National Senior Certificate: A