

The background of the entire page is composed of a repeating pattern of isometric architectural diagrams. Each diagram shows a grid of streets with various building footprints of different sizes and shapes. A small train is depicted on one of the tracks, moving towards the right. The diagrams are drawn in a simple, line-art style with no shading or color.

THESIS

PRACTICAL EDUCATION COMPLEX

AN OPPORTUNITY FOR UNEMPLOYED AND
UNDEREDUCATED YOUTH IN LAVENDER HILL,
SOUTH AFRICA

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Because they made me realize, how privileged I am to grow up in the Netherlands.

PREFACE

This thesis describes the research for a 'Practical education complex' in Lavender Hill, a township in Cape Town, South Africa. It is written in the course of my graduation project for my Bachelor's degree in Build Environment and Infrastructure at Avans University of Applied Science, 's-Hertogenbosch, The Netherlands

The reason to focus my thesis on this subject, came after my five week volunteer ship in an informal settlement in the township Lavender Hill in the summer of 2015. It made me realise, how privileged I am to grow up in the Netherlands. The volunteer ship triggered the idea to do a project for youth who do not have the same privileges. With the graduation theme group 'Borderless Engineering', led by Michiel Smits and Eefje Hendriks, I had the perfect opportunity to create my own project. For that I am very grateful.

This thesis is meant for graduating students like me, who want to research a related subject and for people who want to build a community based project for the education of youth in a South-African township.

I would also like to thank Architect Michael Bol, for being a source of inspiration and helping me to develop the concept and the design for this project. This also applies for the whole team of Molenaar&Bol&VanDillen Architecten, who were always willing to answer my questions.

Finally, I want to especially thank my parents and close friends for accompanying me through the process of the project and helping me during difficult times.

For those who read this thesis, I hope it will inspire you.

Steven Bouma

Veghel, January 12, 2017

ABSTRACT ENGLISH

South Africa is struggling with high youth unemployment. One of the reasons is the state of education. It is widely accepted that education is struggling with poor academic performance of students, lack of access for youth to educational facilities and no or poorly qualified teachers. The result of all this is that young people are hardly prepared for the next step in their education. This leads to high dropout rates with a large number of young people who have little or no education. The supply of unskilled work cannot cope with the influx of unskilled young people. The result is high youth unemployment. Practically oriented education, where young people learn practical knowledge and skills has a positive effect on the chances of young people on the labour market.

The township Lavender Hill in Cape Town is struggling with massive high youth unemployment. 36.1% of youth between 14 and 35 years are unemployed. The finding that there is a lack of a facility in Lavender Hill for giving practical training has led to the design of an educational complex. The aim of the study is to design a complex for practical education In Lavender Hill. The main program of the school will focus on teaching the students building knowledge and techniques.

2 The starting point for the design is, that the complex must be realized by the students of the school themselves together with the community of Lavender Hill. The knowledge and skills acquired in the start-up phase are used in the next stage of development of the complex. In the second stage, the students make a major contribution to the production of materials and the construction of the complex. The design of the construction of the complex as well as the choice of materials will be determined thereby. Similar projects have shown that the principle of Built Together and Learn Together is a successful concept. Students will learn skills in the start-up phase that will help them to increase their employment opportunities. However, this is no guarantee for success for the project in Lavender Hill. Therefore viability of the project has to be evident in the start-up phase. For this reason, it was decided to use temporary construction methods and easy-to-use building materials in the start-up phase, with the ability to transform this, if proven viable, into a permanent construction. In the study, the criteria "self-construction" and "transition from temporary to permanent structure in the different stages" are therefore leading. Self-construction is responding to learned skills and to use these in the next construction stage. So the students can build the next stage of the school themselves. Transition is a selected strategy, whereby it is possible to transfer a temporary construction to a permanent construction in different stages

The following research question was formulated: *How does the design of a complex for practical education in the Township Lavender Hill look like, which is suitable for self-construction and transition.*

To find an answer to the main question, four sub-questions are formulated. The first step to answer the main question is to carry out a literature study about the relationship between the state of education and youth unemployment in South Africa. The literature shows that there is a positive link between the quality of education and the level of youth unemployment in South Africa. The second step is to determine, with use of the Mahoney tables, which requirements are imposed on the design taking into account the characteristics of the Mediterranean climate in South Africa. This shows that ventilation is an important issue. A compact building is recommended, and the façade openings should be of 20-40% of the gross floor area.

The third step is a case study for the construction methods available in South Africa, based on the criteria of self-construction and transition. The score table shows that in the start-up stage it is preferable to use simple construction methods that require little knowledge and skills. In the next stage, the students will participate more and more in the process. They have learned skills and acquired knowledge that they contribute to the construction process. In the development stage more complex construction methods can be used for which knowledge and possession of skills are required. The construction with containers is the most suitable for the start-up stage, because it is the only construction that can serve as a temporary construction. All other construction methods, sandbags with Eco beams, straw light clay, compressed stabilized earth blocks and concrete, are more suitable for the development stage and professional stage. First, because the processing of the materials and the construction methods require more knowledge, skills and experience and second, because these construction methods are more suitable for permanent constructions, they are labour intensive and cannot easily be removed or aborted.

Finally, in the fourth step it is investigated which materials are suitable for self-construction and applicable in both temporary and permanent structures while taking the climatic conditions into account. This is done by a literature study where the results have been weighted in a score table. The analysis of the results show that all the materials, namely containers, timber, sandbags, straw light clay, compressed stabilised earth blocks and concrete are suitable for the construction of the complex. Most of the materials have to be processed in combination with other materials in order to serve as construction material. The straw light clay needs a timber frame, building with sandbags needs eco beam-frames. This requires knowledge, skills and experience. On the other hand, the construction with containers must be done by professionals (transportation, welding etc). But it is most suitable material for a construction in the start-up stage. In a short time, many containers can be placed and a lot of space can be created.

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The answer to the main question is a design for the construction of a school complex for practical education in Lavender Hill. The design is based on the possibility of self-building, in the first stage, use is made of containers. Expansion of the complex will be done by using more complex construction methods and other materials.

It is advisable to do additional research on how to select and approach the youth of Lavender Hill and to identify what the Curriculum of the school should be. What are the consequences for the design and the specific wishes regarding the financing of the complex? It is also important to do additional research on building regulations and specific legislation and regulations with regard to construction in townships in Cape Town. The design must also receive further technical details. Furthermore, a key recommendation is to investigate how control and management of the school will take place and under whose responsibility the project will be established. These subjects are not dealt with in this thesis.

ABSTRACT DUTCH

Zuid Afrika kampt met een zeer hoge jeugdwerkeloosheid. Een van de oorzaken hiervan is de staat van het onderwijs. Een breed gedragen conclusie is dat het onderwijs kampt met slechte schoolprestaties van leerlingen, onvoldoende toegang van de jeugd tot onderwijsvoorzieningen en niet of slecht gekwalificeerde leraren. Het gevolg van dit alles is dat jongeren niet of nauwelijks voorbereid zijn op een vervolg stap in het onderwijs. Dit leidt tot hoge “drop-out rates” waardoor een groot aantal jongeren niet of nauwelijks geschoold zijn. Het aanbod van ongeschoold werk kan de toestroom van niet geschoolde jongeren niet opvangen. Het gevolg is een hoge jeugdwerkeloosheid. Uit onderzoek blijkt dat praktisch gericht onderwijs, waarbij jongeren praktische kennis en vaardigheden aanleren een positief effect heeft op de kansen van de jongeren op de arbeidsmarkt.

Ook de Township Lavender Hill in Kaapstad kampt met een enorme hoge jeugdwerkloosheid. 36.1% van de jeugd tussen 14 en 35 jaar is werkeloos. De constatering dat er het ontbreekt aan een faciliteit in Lavender Hill voor het geven van praktisch onderwijs, heeft geleid tot het ontwerp van een onderwijscomplex.

Het doel van het onderzoek is het ontwerpen van een complex voor praktisch onderwijs. Uitgangspunt voor het ontwerp is dat het complex door de leerlingen van de school en de gemeenschap van Lavender Hill moet kunnen worden gerealiseerd. De opgedane kennis en aangeleerde vaardigheden in de start up fase worden ingezet in de volgende fase van de ontwikkeling van het complex waarbij de studenten zelf een grote bijdrage leveren aan de productie van materialen en het bouwen van het complex. De keuze voor de constructie van het complex alsmede de materiaal keuze zal hierdoor worden bepaald. Vergelijkbare projecten hebben aangetoond dat het principe van Built Together and Learn Together een succesvol concept is. Leerlingen leren hierdoor vaardigheden die hen helpen een betere aansluiting te krijgen op het vervolgonderwijs en ook hun kansen op de arbeidsmarkt te vergroten. Dit is echter geen garantie voor succes voor het project in Lavender Hill. Of er levensvatbaarheid voor het project is, zal in de start-up fase duidelijk moeten worden. Om die reden is ervoor gekozen om in deze fase gebruik te maken van tijdelijke constructiemethodes en eenvoudig te bewerken materialen. Echter wel met de mogelijkheid deze, bij gebleken levensvatbaarheid van het project, te transformeren naar een constructie met een permanent karakter. In het onderzoek zijn de criteria “zelfbouw” en “transitie van tijdelijke naar permanente constructie” daarom leidend. Zelfbouw is het inspelen op aangeleerde vaardigheden en deze inzetten in en volgende bouwphase. Transitie is een gekozen strategie, waarbij het mogelijk is een tijdelijke constructie te laten transformeren tot een permanente constructie.

De volgende onderzoeksvraag geformuleerd:

Hoe ziet het ontwerp van een complex voor praktijkonderwijs in de Township Lavender Hill in Kaapstad, Zuid-Afrika eruit dat geschikt is voor zelfbouw en transitie.

Om een antwoord te vinden op de hoofdvraag is een viertal sub vragen opgesteld. De eerste stap die genomen is om de hoofdvraag te beantwoorden, is het uitvoeren van een literatuurstudie naar het verband tussen de staat van het onderwijs en jeugdwerkloosheid in Zuid-Afrika. Uit de literatuurstudie blijkt dat er een positief verband is tussen de kwaliteit van het onderwijs en de hoogte van de jeugdwerkloosheid in Zuid Afrika. Een tweede stap is genomen om, met behulp van de Mahony tabellen, vast te stellen welke eisen er aan het ontwerp gesteld moeten worden, rekening houdend met de specifieke kenmerken van het Mediterrane klimaat in Zuid Afrika.

Hieruit blijkt dat ventilatie een belangrijk aandachtspunt is. Het compact bouwen wordt

aangeraden en de gevelopeningen moeten 20-40% van het bruto vloeroppervlak zijn.

De derde stap is een case study van de bouwmethoden die in Zuid-Afrika gangbaar zijn, op basis van de criteria van zelfbouw en transitie. Uit de score tabel blijkt dat in de start-up fase het de voorkeur heeft, gebruik te maken van eenvoudige constructie methoden, waarvoor weinig kennis en vaardigheden nodig zijn en die gemakkelijk kunnen worden verwijderd. In de volgende fase zullen de studenten meer en meer participeren in het proces. De studenten krijgen vaardigheden aangeleerd en hebben kennis opgedaan waarmee zij een bijdrage leveren aan het bouwproces. In de “development stage” kunnen meer complexe bouwmethoden worden gebruikt waarvoor kennis en bezit van de vaardigheden vereist is

De constructie met containers is de enige constructie die als een tijdelijke constructie kan dienen en is hierdoor het meest geschikt voor de start-up fase. Alle andere bouwmethoden, namelijk zandzakken met Eco beams, stro/klei stenen en wanden, samengeperste gestabiliseerde aarden blokken en beton, zijn meer geschikt voor de “development and professional stages”. Ten eerste, omdat de verwerking van de materialen en de constructie methoden meer kennis, vaardigheden en ervaring vereisen en ten tweede omdat deze bouwmethoden het meest geschikt zijn voor permanente constructie vanwege de arbeidsintensieve constructie en evenmin gemakkelijk kunnen worden verplaatst of afgebroken.

Tot slot wordt in de vierde stap onderzocht welke materialen geschikt zijn voor zelfbouw en toepasbaar zijn in zowel tijdelijke als permanente constructies hierbij rekening houdend met de klimatologische omstandigheden. Dit is gedaan met een literatuur studie waarbij de resultaten gewogen zijn in een score tabel. De analyse van de resultaten toont aan dat alle materialen uit de analyse, containers, hout, zandzakken, bouwblokken en beton, geschikt zijn voor de bouw van het complex. De mate van zelfbouw verschilt per fase. De constructie met containers is de enige constructie die als een tijdelijke huisvesting kan dienen. Alle andere bouwmethoden in deze studie, zijn arbeidsintensief en kunnen ook niet gemakkelijk worden verplaatst of afgebroken.

Het antwoord op de hoofdvraag is een ontwerp voor de bouw van een schoolcomplex voor het geven van praktisch onderwijs in Lavender Hill. Het ontwerp gaat uit van gefaseerde bouw gebaseerd op de mogelijkheid van zelfbouw en transitie en waarbij in de eerste fase gebruik gemaakt wordt van containers. Uitbreiding van het complex zal plaatsvinden met meer complexere bouwmethodes en andere materialen.

Het verdient aanbeveling aanvullend onderzoek te doen naar de specifieke wensen ten aanzien van de financiering van het complex. Daarnaast is het belangrijk aanvullend onderzoek te doen naar bouwvoorschriften en specifieke wet- en regelgeving ten aanzien voor het bouwen in Townships in Kaapstad. Verder is een belangrijke aanbeveling om onderzoek te doen naar de wijze waarop sturing en leiding gegeven wordt en onder wiens verantwoordelijkheid het project tot stand komt. Deze onderwerpen worden in het kader van deze thesis buiten beschouwing gelaten.

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LIST OF TERMS AND ABBREVIATIONS

- **Apartheid;** Apartheid is a political system that racially segregated the non-whites from the whites in South Africa from 1948 until 1994.
- **Cape Flats;** The Cape Flats is an expansive, low-lying, flat area situated to the southeast of the central business district of Cape Town. To many people in Cape Town, the area is known simply as “The Flats”.
- **CSEB:** Compressed Stabilised Earth Bricks.
- **Department of Education:** The responsibility for education in South Africa is shared by the Department of Basic Education and the Department of Higher Education and Training (DHET). The DBE deals with all schools from Grade R to Grade 12, and adult literacy programmes, while the DHET deals with universities, and other post-school education and training, as well as coordinating the Human Resource Development Strategy for South Africa (HRDSSA) (Department of Basic Education, 2016). When spoken about the Department of Education it concerns the Department of Basic Education.
- **Dropouts:** students which leave primary or secondary education without a diploma
- **Interaction;** Interaction is interpreted as the communication and collaboration between the complex and community when the complex operates in the township
- **ISO;** International Standards Organisation
- **Learn to Earn;** is a skills development and job creating organization seeking to develop people, especially unemployed people, socially, economically, emotionally and spiritually
- **Mahoney tables:** A set of reference tables used in architecture, used as guide to climate appropriate design.
- **NEET's;** a term for young people in South Africa that are Neither Employed nor in Education or Training
- **NEMBA Categories;** the National Environmental Management Categories: Biodiversity
- **NGO (Non-Governmental Organisation);** Is a not-for-profit organization that is independent from states and international governmental organizations that focuses in one way or another on supposed social interest.
- **NYP:** National Youth Policy of South Africa
- **Participation;** In the context of this thesis participation is interpreted as the involvement of the community in the design and building process of the complex.
- **Poverty line;** a minimum income level used as an official standard for determining the proportion of a population living in poverty.
- **Scaling;** is a linear transformation that enlarges (increases) or shrinks (diminishes) objects by a scale factor that is the same in all directions.
- **Self-similarity;** a self-similar object is exactly or approximately similar to a part of itself
- **Township;** In South Africa, the term township usually refers to the often under-developed urban living areas that, from the late 19th century until the end of “Apartheid”, were reserved for non-white residents, namely black Africans, Coloureds and Indians.
- **Tutoring;** After school guidance.
- **TVET:** Technical Vocational Education and Training.
- **Urbanism;** is the characteristic way of interaction of inhabitants of towns and cities (urban areas) with the built environment or - in other words - the charac-

ter of urban life, organization, problems, etc., as well as the study of that character (way), or of the physical needs of urban societies, or city planning. Urbanism is also the movement of the population to the urban areas (urbanization) or its concentration in the urban area. (degree of urbanization).

- **Viability;** Economic viability in the context of this thesis is that the complex proves to be economically feasible, innovative and sustainable in terms of investing financial resources into the project.

CHAPTER 1

INTRODUCTION



1 INTRODUCTION

1.1 PURPOSE

Youth development in South Africa has been shaped by the long history of struggle against apartheid (NYDA, 2015). Prior to 1994, South Africa experienced extreme racial segregation under the apartheid government (Hues, 2011).

Apartheid was a system that racially segregated the non-whites from the whites in South Africa between 1948 to 1994. Apartheid also had a deep impact on the education system, even up to this day (Wolf, 2014; Equal Education, 2016). In South Africa the education system, from basic education to universities, is far from optimal (Statistics South Africa, 2014). The minister of Basic education, Mrs. Angie Motshekga, stated in her foreword in the Five Year Strategic Plan of March 2014, that the key challenges that characterized the education system of South Africa are (Department of Labour, 2010):

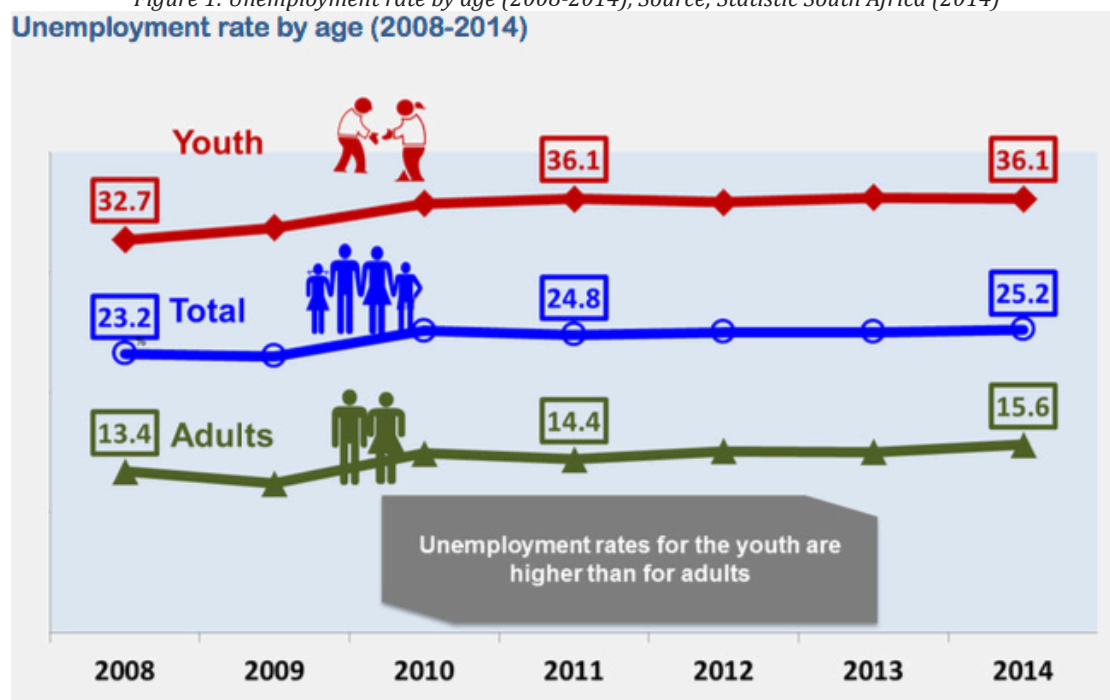
- Poor learning outcomes across all grades;
- Insufficient access to quality teaching;
- Insufficient access to learning facilities and materials;
- Insufficient productivity and effective use of time in the classroom due to poor qualified teachers of teachers;
- General access to basic education for all;
- High Drop out rates and inadequate skills development;

Those key challenges of the education system are one of the reasons for the enormous youth unemployment (Department of Labour, 2010). 36.1% of the youth between 14 and 35 years is unemployed (Statistics South Africa, 2014).

Based on the mandate of the National Youth Commission Act (1996) and the National Youth Development Policy Framework (2002), the NYP 2020 (NYDA, 2015) defines young people as those falling within the age group of 14 to 35 years.

The main challenges which obstruct young people from meaningfully participating in the regular economy are joblessness, poverty and inequality (NYDA, 2015).

Figure 1: Unemployment rate by age (2008-2014), Source; Statistic South Africa (2014)



The high rate of youth unemployment is due to several causes (NYDA, 2015):

1. The low quality of education level; about 47 per cent of 22 to 25-year-olds in the country have completed Grade 12, compared to 70 per cent in most developing countries.
2. The literacy and numeracy skills at primary school level are well below the international average (Department of Basic Education, 2014).
3. A large number of young people exit the education system prematurely and possess no professional or technical skills, making them effectively unemployable. About 60 per cent of unemployed youth aged below 35 years of age have never worked (NYDA, 2015).
4. Poor-quality results in primary school lead to weak participation in other school levels.
5. Only a small number of those who leave the schooling system enrol in technical vocational education and training (TVET).
6. Those who leave school do have a lack of work experience (NYDA, 2015).

One of the issues is the inadequate skills development, which undermines access to opportunities on the labour market. The demand and supply relations in the labour market are very complex (Department of Basic Education, 2014). The very slow adaptation of the education system to the demands of the labour market make that the knowledge and skills of students often do not match with the demands of the labour market (Department of Basic Education, 2014).

The mismatch between supply and demand on the labour market makes it even more difficult for youth who have had little to no education, to obtain a job (Department of Education, 2006). These youth are also known as “NEETs” (Neither Employed nor in Education or Training), they mostly have not finished school at a higher level than grade 10 and are low-skilled. Youth labelled as “NEETs” very often have a poor background. Their parents are unemployed and they have the only future prospects of living in poverty (Department of Education, 2006). It is of upmost importance to equip this youth group with market related skills to improve their job opportunities (Department of Education, 2006)

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There is widespread acknowledgement of the failings of South Africa’s education system. Government, business, teachers and learners all recognize that skills development has been far from optimal and needs serious attention (Statistics South Africa, 2014). There is a need for a mix of short and long-term solutions. Those solutions must be reflecting a multifaceted comprehensive approach (Department of Labour, 2014).

A new curriculum, which was launched by the Department of Education in 2005, marked a shift in the system from a teacher-centred to a more learner-centred approach (Department of Basic Education, 2015). The most important starting point of the new curriculum has been to connect the education system better to the labour market (Department of Basic Education, 2015). The system has a focus on practical education to teach the students skills. The system prepares them too little for the labour market and life after school (Department of Basic Education, 2015).

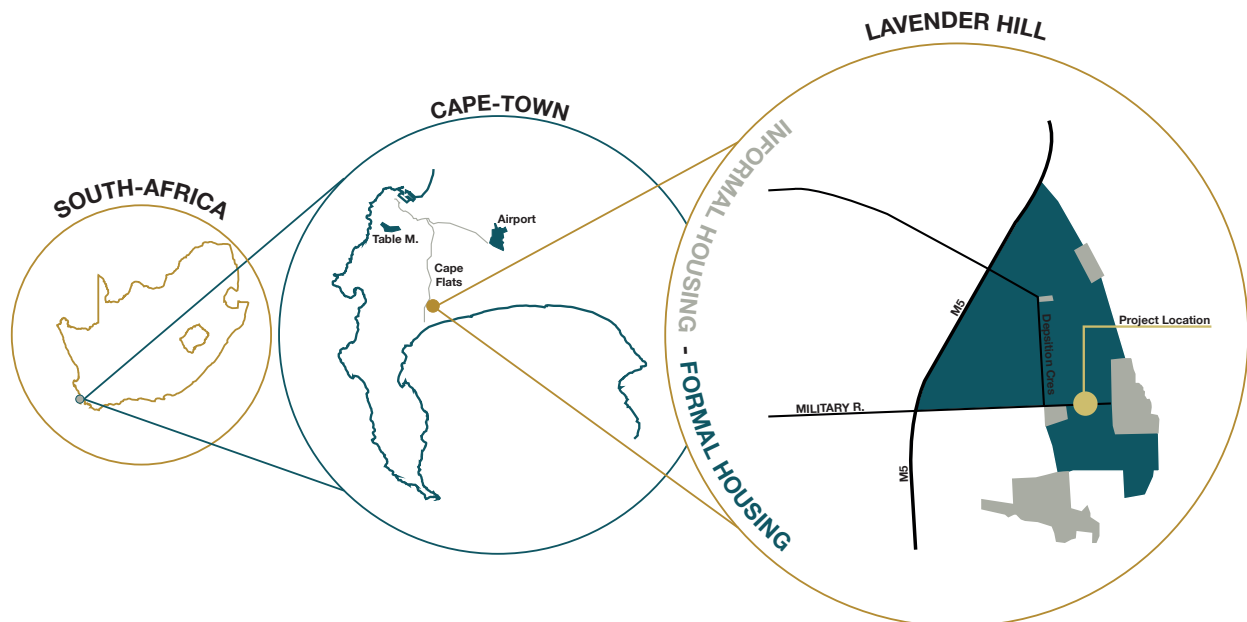
Many schools, especially in townships, are severely under resourced (Hues, 2011). Most of the schools have a lack of basic infrastructure such as sanitation and electricity. The teachers are under qualified, or often not qualified at all (Hues, 2011). Besides availability of qualified teachers another issue is the lack of facilities to give proper education (Department of Basic

Education, 2015). Facilities in terms of school buildings which are well resourced and equipped to give the practical education.

One of those severely under resourced townships in South Africa, is Lavender Hill in Cape Town. It is located 20 kilometres south of Cape Town city centre in the Cape Flats region of Cape Town.

The Cape Flats is an area described by some as “apartheid’s dumping ground”. From the 1950s till 1990s, it was used to house people, designated as non-whites by the apartheid government (Waves for change, 2016). The research focus is on Lavender Hill, because statistics show that Lavender Hill is representative when it comes to high rates of youth unemployment and dropout rates. 42% of the labour force (aged 15-66) is unemployed (SDI&GIS, 2011). The data of the census show that 3.5% of the population never received any education at all, 13% went to Primary School but did not finish the Primary School Education, 8% attended Primary School and finished it, 51% went to a High School but did not finish High School Education, 21.5% finished the High School (Matric) and 3% of the population of Lavender Hill did have some form of Tertiary Education (College, University, other Institutions) (SDI&GIS, 2011). There is not yet a school for practical education (SDI&GIS, 2011).

Figure 2: Project location



1.2 PROBLEM STATEMENT

There is a shortage of education complexes in Lavender Hill, to teach practical education to learn the youth of Lavender Hill skills and competences to prepare them for the labour market and for life after school.

1.3 PROBLEM AREA

Lavender Hill has four schools, three are primary schools and there is one secondary school. One of the main goals of the Department of Basic Education is to reduce the youth unemployment and to stimulate the growth of practical education (Department of Basic Education, 2015). The choice for this thesis for Lavender Hill is motivated by the fact that there is no school for practical education in Lavender Hill (SDI & GIS, 2011). The municipality of Cape Town has designated a location in Lavender Hill specifically for the development of activities for the community. On this location, the complex for practical education will be built.

The residents of Lavender Hill and the students of the school will be involved in the construction of complex.

One of the key criteria for the concept is **self-construction**. In this context “self construction” is meant as using as much as possible, the dedication, knowledge and skills and competences of the young people themselves. The importance of user involvement in construction activities has been widely recognized in efforts to design and build more usable and acceptable systems, acceptable in terms of involvement (Winschiers, 2012).

Experiences from other projects like for instance the Design Indaba and Uquqala project in South Africa, shows that a participatory approach, in which students and inhabitants of the community are involved, does have a positive effect on their motivation to support the project and their personal development (Lepik, 2013). Participation in the building process will help to minimize the costs. Secondly, local individuals and the students will acquire skills and experience that can be applied in the building process (Lepik, 2013). Hereby using the knowledge and guidance of teachers and limit deployment of professionals. It is envisaged that as the students have enjoyed more practical education, they are older and have learned more skills and competences, they make a greater contribution to the expansion of the complex (Wolf, 2014). It is the intention of the project that the students of the school acquire skills and experience so that they are better prepared for the labour market and life after school.

The construction of the educational complex will take place in stages, because the school is built by the students themselves and they first have to acquire some knowledge and skills. The building process of the school runs parallel with the development of the knowledge and skills of students. Therefore **transition** is a selected strategy. This is based on the idea that the school should be able to expend with the growth of the number of students, community interest and their commitment to participate. This bottom-up approach, shows to be successful according to Suzanne Gampfer in Afritecture, Building Social Change (Lepik, 2013). Starting on a small scale is preferable to gain the understanding and trust of the community, experience, skills and knowledge according to Gampfer (Lepik, 2013). In the first stage, the start-up stage, the construction will be simple. In this stage the viability of the project will be tested. Not only the economic viability will be tested but with respect to the community, also their interests and experience. If it appears that there is no interest in and viability for the project, the project will come to a halt and the construction can easily be removed.

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1.4 PROJECT LIMITATIONS

- In the research, funding of the complex is disregarded.
- It does not take into account existing laws and regulations in the area of housing
- Specific regulations for building in Townships are also not taken into account
- Local building regulations are also excluded.

1.5 RESEARCH OBJECTIVE

The focus of this thesis is to design a complex for practical education in Lavender Hill. The design is based on **self-construction** and **transition** with the possibility to extend, depending on community interest and economic viability.

1.6 RESEARCH QUESTION

The following research question is formulated:

How does the design of a complex for practical education in the township Lavender Hill look like, which is suitable for self-construction and transition?

To find an answer to the main question, four sub-questions are formulated in a structured way. These sub questions will provide the right focus in the approach and methodology of this research.

1.6.1 SUB QUESTIONS

1. What is the relation between the state of education and youth unemployment in South Africa?
2. What effect has a Mediterranean climate for the design?
3. Which construction methods available in South Africa are suitable for self-construction and transition?
4. Which building materials are available which meet the requirements of the climate and are suitable for self-construction and transition?

1.7 RESEARCH STAGES

1.7.1 START-UP STAGE

In the start-up stage of the school, it is important that the community gets involved and that young people will help with the construction of the education complex.

Because there are probably only a few students who can contribute to the process, a provision for the space needed will be provided with the help of professionals. This stage involves building a facility in a short time at low cost with basic amenities such as water, plumbing and electricity.

Characteristics for this phase are:

- Construction method that is realized easily and quickly;
- Built by professionals with help of students and members of the community;
- Students become a little acquainted with materials and basic techniques;
- Simple construction methods and equipment;
- Basic facilities are available;
- Limited range of courses primarily aimed at construction;
- Period 1-4 months;

1.7.2 DEVELOPMENT STAGE

If it appears that it is a viable concept the assumption is, that the number of students will grow. More classrooms will be necessary and more and better facilities are needed. The students are by now familiar with simple materials and simple construction methods and can therefore participate in the building process.

Characteristics for this phase are:

- Built by students with help of professionals and teachers.
- Simple to more complex construction methods and equipment;
- Simple materials;
- Easy to extend;
- More and better facilities like air movement, double banked rooms, more class-

- rooms;
- Expanding the range of courses with some new courses as well;
- Production line will be started to provide materials for the construction;
- Period 4-24 months;

1.7.3 PROFESSIONAL STAGE

In this stage the students are well educated and have obtained several skills and competences. They are capable to use complex materials and constructing methods. In this stage, multiple disciplines are added to the curriculum of the school.

Characteristics for this phase are:

- Students make products and build further develop the complex with little help of professionals;
- Simple and complex construction methods and the use of complex (electrical) equipment;
- Simple and complex materials are used;
- All necessary facilities are available in the complex;
- Multiple disciplines are added to the curriculum of the school in this stage;
- A varied range of courses;
- Production line is full in progress;
- Period > 24 months;

Table 1: Different stages of the research process

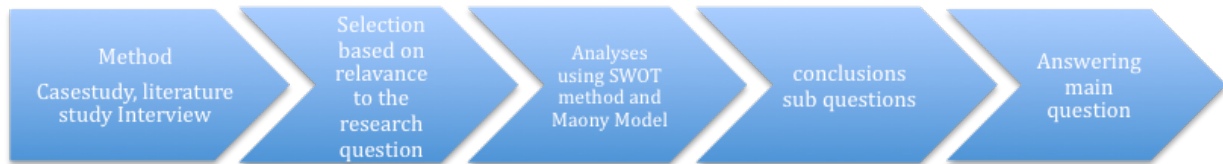
| | Stage 1 START UP | | Stage 2 Development | | Stage 3 Professional |
|-------------------------------------|--|--|--|--|--|
| Temporary or permanent construction | Temporary | | transitie van temporay to permanent | | permanent |
| Main activity | Education | | Education and production | | Education and production and sales |
| Skills and competences | practical skills, | | practical and basic technical skills | | Technical skills |
| Use of materials | use of materials that can be processed with a simple instruction | | use of materials for which a limited training is required | | Use of all kinds of materials for which training is required |
| Construction methods | construction methods that can be performed with simple instruction | | construction methods that can be performed with a limited training | | construction methods for which training is required |

1.8 RESEARCH DESIGN

In this chapter, the different steps to reach the research objective are described. The used methods are explained and motivated. The main research question is answered using the results and conclusions of the answers of the sub questions.

The research process consists of the following steps:

Table 2: Research process



1.8.1 METHODOLOGY

The methods used to answer the sub-questions are:

Table 3: Research methods, techniques and tools

| SUB QUESTION | RESEARCH METHOD | SELECTION CRITERIA | SOURCES |
|--------------|------------------------------------|--|---|
| 1 | • Field research and desk research | • Experts in the field of education and youth work. • Employees of the Community Centre and inhabitants of Lavender Hill with expertise in community work | • Literature analysis • Interviews |
| 2 | • Desk research | • Self-construction • Transition | • Literature analysis |
| 3 | • Desk research | • Self-construction • Transition | • Case study • Additional resources like the internet |
| 4 | • Desk research | • Self-construction • Transition | • Literature analysis Reviews of publications Reviews of thesis's |

The research method is determined before the start of the study. A qualitative research method is chosen. The research method that is used, is a structured method of looking for a solution in the form of an opinion or design. It is a qualitative research because the research question is an open question (Baarda, 2009). In addition, the research is wide and relatively little is known about the topics and information that are required (Baarda, 2009). According to Baarda (2009): "Qualitative research is research in which problems and situations, events and people are described and interpreted, using data of a qualitative nature, such as perceptions, experiences, meaning grants collected through open interviews and/or participant observation and/or existing documents (Baarda, 2009)."

The qualitative research will be composed of desk research and field research. The combination of desk research and field research should lead to a report that combines both theory and practice.

The first part of the study consists of a desk research. In the desk research, the existing research on the information is gathered through a literature review and a case study. Literature review is a method to gather existing knowledge on the subject. Through various sources, such as books, web pages, scientific articles and papers, different knowledge is acquired (Baarda, 2009). The literature analysis was done to find answers to questions 2 and 4.

A case study is done to answer sub question 3. This case study is done for the benefit of the general perception about building methods and materials that have been used in other projects.

The second part of the study consists of field research. Nine open interviews are held with people working within the field of education, youth work and community work. In an open interview, there usually is a fixed opening question to start with. The follow-up questions are based on the answers and the respondents' input. An open interview is sometimes working with a topic list (Baarda, 2009). The search of the candidates was done through searching the internet and the selection is made on the basis of the curriculum vitae.

To answer sub question 1, about the relationship between the state of practical education and youth unemployment, research is done by both a literature study and interviews, in order to understand the problems of the education system and to identify the underlying causes of the high youth unemployment.

The selection of the material and methods is done on the base of the criteria of ***self-construction*** and ***transition*** in relation to the stage in the building process.

For the analysis of the data, a SWOT analysis is chosen as it is a technique to identify strengths, weaknesses, opportunities and threats and therefore most suitable for analysing the advantages and disadvantages of the various materials and methods (Armstrong, 2015).

SWOT is an acronym for;

- **Strengths:** characteristics of the material and methods that give it an advantage over others;
- **Weaknesses:** characteristics of the material and methods that place material and methods at a disadvantage relative to others;
- **Opportunities:** elements in the environment that the material and methods could exploit to its advantage;
- **Threats:** elements in the environment that could cause trouble for the material and methods;

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Of each type of material and construction method the advantages and disadvantages will be described and weighed against the criteria of:

- Self-construction
- Transition

The results are shown in a score table:

Table 4: Score table

| MATERIAL/ METHOD; | SCORE |
|---|------------|
| SELF CONSTRUCTION | |
| FULLY SELF CONSTRUCTION | 20 |
| MOSTLY SELF CONSTRUCTION | 10 |
| SOME SELF CONSTRUCTION | 0 |
| MINIMUM SELF CONSTRUCTION | -10 |
| NO SELF CONSTRUCTION | -20 |
| TRANSITION | |
| SUITABLE FOR ALL STAGES | 20 |
| SUITABLE FOR DEVELOPMENT AND PROFESSIONAL STAGE | 10 |
| SUITABLE FOR PROFESSIONAL STAGE | 0 |
| SUITABLE FOR START-UP AND DEVELOPMENT STAGE | -10 |
| SUITABLE FOR START-UP OR DEVELOPMENT STAGE | -20 |
| TOTAL SCORE | |

The table components can have a positive or a negative score. So it may be that an overall score is positive while one of the criteria scores negative. The more points are awarded, the better the project is in line with the research objective. Of each sub question a conclusion is made. The sub conclusions together give an answer to the main research question.

1.8.2 RESEARCH DELIVERY'S

- *Thesis:* Contains the study design with all the relevant answers to the sub questions and the final conclusion of the research;
- *Design:* These are the drawings of the design;
- *Final presentation:* The final presentation will include all documents showing how the design looks like;

CHAPTER 2

RESEARCH RESULTS



2. RESEARCH RESULTS

2.1 SUB QUESTION 1: WHAT IS THE RELATION BETWEEN THE STATE OF EDUCATION AND YOUTH UNEMPLOYMENT IN SOUTH AFRICA?

The Apartheid era broke up the education policy framework into 19 different departments, which were defined by racial segregation (UK Essays, 2015).

During the Apartheid, the South African education system was divided by race. Non-whites were stripped of any educational resources, facilities and qualified teachers. This downgraded the quality of the education for non-whites to a very low level (UK Essays, 2015).

Although the government has successfully achieved small improvements in the education system, South Africa is still facing a huge youth employment crisis with unprecedented proportions (NYDA, 2015). According to the South African June 2014 Labour Force Survey, 36.1% of young people between the ages of 15 and 35 are unemployed (NYDA, 2015). More than 31 per cent or 3.3 million of the youth aged 15–24 are neither employed nor in the education or training systems – the “NEET” category (NYDA, 2015).

There are several reasons for the high rate of unemployment;

- Legacy of structural inequality;
- Failing education system;
- Lack of access to education facilities for children;
- Lack of jobs for unskilled workers;
- People lacking the skills to enter the labour market;

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The repetitive effect is deepening of poverty, and a continued lack of access to job opportunities for generation after generation (Brandsouthafrica.com, 2014).

In developed economies, there is a strong link between the level of education and the chance of getting a job (ILO, 2013). But in developing economies such as in South Africa, more human capital development and higher levels of education do not automatically translate into greater opportunities in the labour-market outcomes and more jobs (NYDA, 2015). So far shown, in South Africa there is no positive correlation between higher education levels and declining unemployment rates among youth (ILO, 2013).

South Africa does have a National Youth Policy (NYP). In 2015 a new NYP was developed. The first NYP covered the period 2009-2014. The new NYP 2020 is for the period 2015 to 2020. The progress made in the period 2009-2014 is insufficient (NYDA, 2015; Department of Basic Education, 2014). All kinds of interventions to improve the skills and opportunities of young people to give them a better chance to participate in the labour process, did not have enough impact. The quality of education and educational outcomes remain a challenge (Department of Basic Education, 2014).

NYP 2020 has a focus on redressing the wrongs of the past and addressing the specific challenges and immediate needs of the country's youth and the problems they are facing (NYDA, 2015).

Some of the main problems are the high Drop Out Rates and inadequate skills development,

due to the poor quality of education at all levels of the system. There are still too many obstacles that undermine an equal access to the labour market (NYDA, 2015; Department of Basic Education, 2014).

South Africa's high rate of youth unemployment is largely attributed to the skills shortage in this age group. Large numbers of young people exit the education system prematurely and due to that, lack professional and/or technical skills (NYDA, 2015; Department of Basic Education, 2014).

To reduce the high levels of youth unemployment in South Africa, the economy requires to develop a more labour orientated growth pad. This depends on a successful reorientation of the economy to raise labour demand, with matching improvements on the supply side (NYDA, 2015).

2.1.1 RESULTS OF THE INTERVIEWS

In February 2016, a field research has been conducted in Cape Town to understand the relationship between the state of education and youth unemployment in South Africa.

A qualitative research method is chosen because this provides insight into the "What and why" question. Nine semi-structured interviews are conducted. The results of six interviews are included in this thesis. The results of the remaining three interviews have not enough relevance to the main research question or the sub research questions and are therefore not taken into consideration. The transcripts of the interviews can be found in appendix 1.

The persons interviewed are:

| NAME: | FUNCTION: |
|--------------------|--|
| Mrs. Bernie Thomas | Employee community centre and resident Lavender Hill |
| Mr. Edward Thomas | Employee community centre and resident Lavender Hill |
| Mr. Kayin Scholtz | Manager Impact Centre, SAEP |
| Mr. Mike Louw | Lector University of Cape Town |
| Mr. Peter Hagen | Section Leader True North |
| Mrs. Susan Wishart | Location manager Khayelitsha Campus |

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The interviewees are chosen because of their experience in the field of youth education and unemployment.

The interviews are firstly held to gain insight in the reasons and the problems concerning youth unemployment in Cape Town, South Africa. Secondly, the interviews are held to examine potential solutions that are in operation. Finally, the goal was to learn about youth education and unemployment projects that are already proven successful.

The first interview is held with Mr. Peter Hagen, Section Leader of True North. True North is an organization that wants to bring meaningful change to vulnerable and underprivileged communities in South Africa through education, research and the sharing of technology (Annual Report True North, 2015).

According to Hagen (2016) the mind-set in South Africa is that: *"If you want a good future for yourself, you have to go to university"*. The result is, that everybody wants to go to the university, regardless their capacity and previous education (Hagen, 2016). You have failed as a person, if you do not go to university. In the education prior to university students get

stuck in the system, because not everybody has the capacity for university education (Hagen, 2016). In addition, the quality of basic education is very low. Many children don't get to the right level to have a smooth transition to further education (Hagen, 2016).

The result is a high number of "Dropouts" and classes with students from the age of twelve to eighteen years of age. Alternatives such as vocational or practical education are barely offered and besides that, have an image problem (Hagen, 2016).

A second issue, according to Hagen (2016), is that learning disabilities and learning delays are diagnosed insufficiently. Sometimes the causes for these problems are physical problems, like bad sight and hearing, which are not recognized and thus not treated. Behavioural problems, caused by conditions students grow up in, are not treated as well (Hagen, 2016). The school system is simply not adequate to bring a hold to these kinds of problems, with the result that students drop out at a young age. This is also one of the causes of the high drop out rates (Hagen, 2016).

Meanwhile, the South African Department of Education has acknowledged these problems, but has not enough financial resources to reform the education system drastically, according to Hagen (2016).

According to Wishart (2016) different initiatives are developed (mostly privately financed) to tackle youth unemployment. Mrs Susan Wishart, is location manager of a Learn to Earn campus in Khayelitsha. Learn to Earn is a skills development and job creation organization. It's mission is to develop people, especially unemployed people, socially, economically, emotionally and spiritually (Learn to Earn, 2016). According to Wishart (2016) one of the main causes of high unemployment is a vicious circle. Children are not well educated due to the state of basic education. They don't have the skills to enter the workplace and there is not enough work for unskilled people.

The projects of Learn to Earn take place on a small scale (Wishart, 2016). They offer a programme of courses and trainings, to give the youth a possibility to obtain a better connection to the labour market, or to start a business themselves, regardless its size (Wishart, 2016).

Learn to Earn specifically examines the demands of the (local) labour market. They only provide courses and trainings that offer employment. The students have the option of receiving tuition, for example in sewing, woodwork, technical skills, office administration, as well as basic computer lessons (Learn to Earn, 2016). Sometimes the offer of courses is determined locally (Wishart, 2016). An example is a project of 'Learn to Earn' in the town Hermanus, south of Cape Town. A lot of people living in Hermanus are retired. Therefore Learn to Earn started a program for elderly care, this is a good example of customization according to Wishart (2016). Emphatically, they try to connect their students with local business related to their course or training, so that they can gain work experience in practice. If that is not possible, they try to mimic this experience as much as possible at the campus (Wishart, 2016). Learn to Earn wants their students to learn, that having work demands structure and discipline and that regulations apply (Wishart, 2016). Some youth do not realise that, if you want to have an income, you need to work for that an entire day. Next to education, the personal and mental development of students is very important for Learn to Earn (Wishart, 2016).

The success of these initiatives lay in their marked focus, as stated by Wishart (2016). Over 80% of their graduates become economically active, with up to 11% starting their own businesses (Wishart, 2016).

According to Louw, Mr. Mike Louw is lector of the Cape Town University, small scale projects have been developed over the years to educate practical skills to youth. These projects are in principle very successful (Louw, 2016). Those started at a small scale in the communities are more successful than those which were started by the government.

According to Thomas (2016), there are some hopeful projects but many of these projects have an end. Youth attending these projects are left behind and end up with nothing, because they do not have other opportunities afterwards or because they do not know what to do with the learned skills.

Mr and Mrs Thomas are both employers of the community centre in Lavender Hill and are involved with community work on a daily basis. According to Louw as well as to Thomas (2016), it is important to provide perspective for the students, so that they can do something with the learned skills and experience. This can be provided by coaches, who help the students finding a job or establishing their own business. These students can get involved in new projects also, in which they can use their experience and knowledge to further develop themselves (Thomas and Louw, 2016).

2.1.2 SUB CONCLUSION

The literature study shows;

- The apartheid regime is still of influence to the state of the education. There is still a legacy of structural inequality.
- The Government has taken measures in the past leading to small improvement but there is still some huge youth unemployment.
- The high rate of youth unemployment is largely attributed to the skills shortage of the students.
- The level of education is poor, due to teachers who are ill-qualified or unqualified.
- There is a lack of access to education facilities.
- There is a skills shortage among youngsters, because they leave school prematurely.
- In South Africa there is no strong link between an educational level and the chance of labour like in developed economies.
- There are high dropout rates.

The interviews show that;

- High dropout rates occur because children have often not the right level to have a smooth transition to further education.
- There are high dropout rates due to mismatch between the demand and the supply on the labour market.
- Learning disabilities and learning delays are often not recognized. Children do not get proper treatment and guidance is missing.
- The supply of unskilled youngsters is higher than the available unskilled jobs and high youth unemployment is the result.
- Projects to reduce youth unemployment are more successful if they focus on the demand on the labour market.
- Students must have a perspective so that they can do something with the knowledge obtained and the skills learned.

There is no single solution to the reduction of youth unemployment. Increasing participation by young people in the labour market will require a multiple approach. There is a relation between the state of education and the rate of youth unemployment in South Africa. South Africa is dealing with a poor academic performance of students, lack of access of youth to educational facilities and no or poorly qualified teachers. The result of all this is that young people are hardly prepared for the next step in education. This leads to high dropout rates with a large number of young people who have little or no education. The low supply of unskilled work cannot cope with the high influx of unskilled young people. The result is high youth unemployment.

2.2 SUB QUESTION 2: WHAT EFFECT HAS A MEDITERRANEAN CLIMATE FOR THE DESIGN?

The climate is an important shape determining factor in architecture and building engineering. Orientation, form and the choice of materials have long been the logical consequence of locale climatic conditions (Egmond, 2006). For the design and also the engineering of buildings in the Tropics or related climates, architects and building engineers have to deal with climatologically factors.

The climatologically factors that effect the indoor climate and comfort for humans in buildings are; (Egmond, 2006)

- Air temperature,
- Air humidity
- Hours of Sunshine
- Rain fall
- Wind speed en direction

Temperature is the most important factor in generating a sense of thermal comfort, relative humidity together with temperature also plays a large role in the sense of discomfort in a building. High levels of relative humidity can work against the evaporative cooling effects of sweating and leave the body prone to over-heating. Further, high levels of relative humidity in inclement winter weather produce a greater sense of cold (Boduch, 2009).

The climate is therefore of importance for the choice of the building materials. To determine at what temperature and humidity most of the people feel comfortable, the Human Comfort Limits score is used.

Table 5: Human Comforts Limit, source; (Egmond, 2006)

| Annual mean temp | > 20°C | | 15-20°C | | < 15°C | |
|---------------------------|--------|-------|---------|-------|------------------|------------------|
| Average relative humidity | Day | Night | Day | Night | Day | Night |
| 0 - 30 % | 26-34 | 17-25 | 23-32 | 14-23 | 21-30 | 12-21 |
| 30 - 50 % | 25-31 | 17-24 | 22-30 | 14-22 | 20-27 | 12-20 |
| 50 - 70 % | 23-29 | 17-23 | 21-28 | 14-21 | 19-26 wij | 12-19 wij |
| 70 - 100 % | 22-27 | 17-21 | 20-25 | 14-20 | 18-24 | 12-18 |

2.2.1 THE CLIMATE IN CAPE TOWN

In South Africa there are multiple climate zones: Tropic, Sub-tropic, Mediterranean and desert climate (Climateps, 2015). Cape Town has, based on the Köppen Geiger climate classification system, a Cs climate type, also known as a Mediterranean climate (Peel, 2007).

One of the features for this Mediterranean climate is a strong influence of a nearby sea or ocean. The Mediterranean is a moderate climate with great differences between the driest and the wettest months. The driest month counts less than 10 mm precipitation. The wettest month however, has at least 90 mm precipitation. There are high temperatures in the summer, moderate temperatures and precipitation in the winter (Peel, 2007).

The location of the education complex is in Lavender Hill, a township in Cape Town, South

Africa.

From a climatologically point of view, the design requirements for the complex are:

The building needs to have a comfortable indoor climate because of high temperatures in the summer and the mild winters with humid weather.

- Windows need to be able to be opened and closed
- Air and waterproof
- Provisions for drainage of rainwater.

In the design process, Mahoney tables have been used. The Mahoney tables are a set of reference tables used in architecture as a guide to climate-appropriate design. There are six tables; four are used for entering climatic data for comparison with the requirements for thermal comfort; and two for reading off appropriate design criteria (Heerwagen, 2003).

- Air Temperature
- Humidity, precipitation and wind
- Comparison of Comfort Conditions and Climate
- Indicators
- Schematic Design Recommendations
- Design Development Recommendations

The various tables have helped to formulate guidelines for the design, which take the climate conditions fully into account. The results of these analyses and the answers to the sub question can be found in Appendix 2.

2.2.2 SUB CONCLUSION

The analysis shows that:

1. It is preferable to use double banked rooms
2. A temporary provision for air movement is necessary
3. It is preferable to build compact.
4. No extra provisions have to be made for extreme weather conditions such as strong winds and extreme colds.

Despite the fact that average day temperatures in Cape Town do not rise above the average comfort temperatures, the temperature is very high for a few months of the year. A high temperature in combination with high humidity makes it worthwhile to applying a form of ventilation in the design of the building.

2.3 SUB QUESTION 3: WHICH CONSTRUCTION METHODS AVAILABLE IN SOUTH AFRICA ARE SUITABLE FOR SELF-CONSTRUCTION AND TRANSITION?

One of the principles of the design of the education complex is self-construction. Before making a choice in building materials and construction methods. It is good to know which construction methods are present in South Africa, that meet the criteria of self-building and transition. As the research method, case study is chosen.

The expected outcome of case studies is that construction methods and materials, which require more complex building process, will better score in the development and professional stage.

The following cases have been chosen for the case study. The choice for the cases is based on the possibility of self-construction and transition.

- Guga S' Thebe Theatre
- Design Indaba 10x 10 sandbag houses
- Ithuba Skills College
- Red location
- Ukugala; Build Together, Learn Together.

In all these cases the community participates more or less in the building process, which is a criteria for self-construction.

But these cases also show specific constructive and material characteristics decisive for inclusion in the research. For example: the choice for Guga S' Thebe Theatre is first off all because of its use of containers as a construction method. In the start-up phase of the design of the school it is important to have space available quickly and containers can be used for this. Design Indaba 10x 10 sandbag houses, is chosen because of its use of Eco beams, a relatively new construction method. Ithuba Skills College is chosen, because it is also a school complex built with the help of students. Red Location is chosen, because a traditional construction method is used in the building process. Finally, The Ukugala is chosen because of the participative approach of the project

A SWOT analysis is made of each case, to determine what construction method is suitable in the context of self-construction and transition. The results are set against each other in a score-table, table 6.

Table 6: Score-table self-construction and transition

| MATERIAL/ METHOD; | SCORE |
|---|--------------|
| SELF CONSTRUCTION | |
| FULLY SELF CONSTRUCTION | 20 |
| MOSTLY SELF CONSTRUCTION | 10 |
| SOME SELF CONSTRUCTION | 0 |
| MINIMUM SELF CONSTRUCTION | -10 |
| NO SELF CONSTRUCTION | -20 |
| TRANSITION | |
| SUITABLE FOR ALL STAGES | 20 |
| SUITABLE FOR DEVELOPMENT AND PROFESSIONAL STAGE | 10 |
| SUITABLE FOR PROFESSIONAL STAGE | 0 |
| SUITABLE FOR START-UP AND DEVELOPMENT STAGE | -10 |
| SUITABLE FOR START-UP OR DEVELOPMENT STAGE | -20 |
| TOTAL SCORE | |

The underlying data of the analyses can be found in appendix 4.

Guga S' Thebe Theatre

Location: Township Langa, Cape Town

Architects: RWTH Aachen, PBSA Düsseldorf, Georgia institute of Technology and University of Cape Town and local architects Carin Smuts from CS studio.

Materials:

- Reused shipping Containers
- Timber roof construction
- Facades of recycled old wood fruit crates
- Walls of Recycled Car tyres, straw and Clay
- Transparent PVC roof

Construction:

- Frame of containers
- Two storey building
- Cantilevered roof made of wood

Building time: < 4 months

Building method with containers creates spaces quickly and is suitable for self-construction.

10x10 Housing Project, Freedom Park, Cape Town

Location: Freedom Park, Cape Town

Architects: MMA architects Luyanda Mpahlwa and, Kirsty Ronne

Materials:

- Timber Frames with a steel body frame
- Sandbags
- Plaster
- Timber boarding
- Timber facades

Construction:

- Eco beams, A timber frame filled with sandbags.
- Simple construction method, machines and electric tools are not necessary

Building Time: > 4 months

This project responds to the participation of the community. The use of wood and sandbags sounds simple and it is. Is this construction suitable for self-construction and in what stage?



figure 3: Guga S'Thebe Theatre, source: (ddb-sa, 2017)



figure 4: 10x10 Housing Project, source: (Archigraphy, 2014)

Ithuba Community College, Johannesburg

Location: Magagula Heights, about 40 kilometres south-east of Johannesburg.

Architects: RWTH Aachen together with Christopher Chorherr chairman of the Association S2arch

Materials:

- Grass and straw
- Grass
- Corrugated metal roofs
- Roof panels
- Steel trusses
- Concrete Blocks, manufactured by local unemployed community members
- Timber
- Top layer of plaster

Construction:

- Light Clay Building
- Concrete construction.
- Masonry walls of bricks
- Simple construction method. Machines and electric tools are not necessary

Building Time: >4 months

This project also responds to the participation of the community. Is this construction suitable for self-construction and in what stage?



figure 5: Ithuba Community College, source: (architectureindevelopment, 2016)

Red Location

Location: New Brighton, in Port Elizabeth.

Architects: Noero Wolff Architects

Materials:

- Simple, polished concrete pillars
- Not plastered brick walls
- Saw tooth roof construction
- Corrugated COR-TEN Steel
- Timber

Construction:

- Masonry walls of bricks
- Complex roof construction
- Simple and complex construction methods, machines and electric tools are necessary

Building Time: > 4 months

This project partly responds to the participation of the community. Is this construction suitable for self-construction and in what stage?



figure 6: Red location, source: (Southwood, 2011)

Ukugala; Build Together, learn together - “ Village of Hope”

Location: Township of Grabouw, seventy Km south of Cape Town.

Architects: Leslie Koch and fellow student Ulrike Perlman, Degree Candidates, University of Stuttgart

Materials:

- Loam
- Straw
- Timber
- Corrugated metal (rusted steel)

Construction:

- Double roof construction
- Wooden frame
- Walls of loam
- Machines and electric tools are not necessary

Building Time: > 4 months

This project responds to the participation of the community. Is this construction suitable for self-construction and in what stage?



figure 7: Ukugala - Build together, learn together; source: (Gaudecker, 2011)

2.3.1 SUB CONCLUSION

The score table shows that in the start-up stage it is preferable to use simple construction methods that require little knowledge and skills. In the next stage, the students will participate more and more in the process. Students have already learned skills and acquired knowledge that they contribute to the construction process. In the development stage more complex construction methods can be used for which knowledge and possession of skills are required. The construction with containers is the only construction that can serve as a temporary construction and is therefore the most suitable for the start-up stage. All other construction methods, as sandbags with Eco beams, straw light clay, compressed stabilized earth blocks and concrete, are more suitable for the development and professional stage. First of all, because the processing of the materials and the construction methods require more knowledge, skills and experience, secondly, because the construction method is more suitable for a permanent construction. It needs labour intensive construction methods and cannot be moved easily or aborted.

2.4 SUB QUESTION 3: WHICH BUILDING MATERIALS ARE AVAILABLE THAT MEET THE REQUIREMENTS OF THE CLIMATE AND ARE SUITABLE FOR SELF-CONSTRUCTION AND TRANSITION?

In the selection of materials, the climatological requirements that are the results of the research into the climate are taken into account. These results were drawn up using the Mahony table, shown in sub question 2.

1. The use of double banked rooms with the provision of temporary air movement;
2. The use of compact planning for spacing;
3. Medium openings in the façade will be 20-40% of the gross floor area;

These requirements relate to the design and construction methods. The analysis of the materials is based on the outcome of the case studies.

In the research the following materials are therefore chosen:

- Containers
- Timber
- Sandbags and Eco-beams
- Straw light clay
- Compressed stabilised earth blocks
- Concrete

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To research the usability of the materials and methods for this project the criteria which determine the final choice are the possibility of self-construction and transition in the context of the project as mentioned before. Self-construction in the context of this thesis means, the extent to which students can build their own school and are able to produce the materials themselves, materials that are to be used in building the complex, with simple techniques and means. For this reason, several materials are not included in the study. These are mainly non-natural materials, which before they can be used, usually must endure a machining process in a factory.

The choice for containers is first off all because of the availability through the nearness of the Port of Cape Town. In the start-up phase it can be important to have space available quickly, with limited effort and at low cost. The residents of Lavender Hill use of containers as building method themselves, for example for small shops.

Timber is chosen because it is easy to process and also sufficiently available. Timber is commonly used in South Africa, for example in construction methods or as decoration for houses and buildings.

Straw Light Clay is chosen because it is a common building technique with materials that are sufficiently present. The choice of sandbags with eco beam frame is motivated by the fact that sand is present locally in a sufficient extent. Timber for the frame is also sufficiently available.

Compressed Stabilised Earth Bricks are selected because they are commonly used in building construction in South Africa and because they are made of natural products. Concrete is chosen as well because it is made of naturally available materials.

A SWOT analysis is made of each material, to determine what material is suitable in the context of self-construction and transition. The results are set against each other in a score-table, table 7:

Table 7: Score-table self-construction and transition

| MATERIAL/ METHOD: | SCORE |
|---|--------------|
| SELF CONSTRUCTION | |
| FULLY SELF CONSTRUCTION | 20 |
| MOSTLY SELF CONSTRUCTION | 10 |
| SOME SELF CONSTRUCTION | 0 |
| MINIMUM SELF CONSTRUCTION | -10 |
| NO SELF CONSTRUCTION | -20 |
| TRANSITION | |
| SUITABLE FOR ALL STAGES | 20 |
| SUITABLE FOR DEVELOPMENT AND PROFESSIONAL STAGE | 10 |
| SUITABLE FOR PROFESSIONAL STAGE | 0 |
| SUITABLE FOR START-UP AND DEVELOPMENT STAGE | -10 |
| SUITABLE FOR START-UP OR DEVELOPMENT STAGE | -20 |
| TOTAL SCORE | |

The underlying data of the analyses can be found in appendix 5.



*figure 8: Freight container building example,
source: (Inspiring Home Ideas, 2016)*



figure 9: Sand bag building method example, source: (archRE-think, 2015)



figure 10: Straw light clay building method example, source: (Handersen, 2014)



figure 11: CSEB building method example, source: (Made in Earth, 2015)

2.4.1 SUB CONCLUSION

The analysis of the results shows that all the materials are suitable for the construction of the complex. The degree of self-construction differs per stage. Containers together with timber and concrete are appropriate in the start-up phase and exclusively used for simple construction work. Containers can rapidly fill in the need for space and are easily placed and picked up, using the right equipment. In the start-up stage, there are no skilled students who can help, so professionals have to complete this job. Building a construction with straw light clay or another material needs time and is more labour-intensive. It is cheaper in this stage to work with containers.

The construction with containers is the only construction that can serve as a temporary housing. All other construction methods in this study are labour intensive and cannot be easily moved or aborted.

Most of the materials should be processed in combination with other materials to be able to serve as construction material. The straw light clay needs a timber frame as well as building with sandbags. Self-construction in the start-up stage is limited to simple support work partly because transport, setting, securing and applying to change the containers, are work for professionals. It requires specialized knowledge and equipment like welding machines and welding techniques. The participation of the community and the students can be, for example, helping to make the foundation for the containers and other activities that require little skill and experience.

Applying double banked rooms with the provision of temporary air movement asks a large number of adjustments to the construction of the containers. In all the other phases it will be incorporated into the design and a provision is made in the construction phase. It will be carried out during the construction process.

In all stages is possible to take account of a compact planning and the use of medium openings. It is part of the design and can be carried out during the construction process.

CHAPTER 3

CONCLUSION



3. CONCLUSION

This research was conducted with the aim to provide an answer to the main question:

How does the design of a complex for practical education in the Township Lavender Hill look like, which is suitable for self-construction and transition?

To give an answer to the main question, the main question is divided into four sub-questions:

1. What is the relation between the state of education and youth unemployment in South Africa?
2. What effect has a Mediterranean climate for design?
3. Which construction methods are available in South Africa that are suitable for self-construction and transition?
4. Which building materials are available that meet the requirements of the climate and are suitable for self-construction and transition?

Apartheid has had a deep impact on the education system in South Africa. Blacks were not admitted to good quality education and the education they were offered was of very poor quality. Overcrowded classes, lack of facilities and poorly qualified teachers were to blame. The resulting backlog of a large part of the predominantly black population is noticeable until today, despite various measures and policies of the different government agencies.

There is a relation between the state of education and the rate of youth unemployment in South Africa.

South Africa is still dealing with poor academic performance of students, lack of access of youth to educational facilities and no or poorly qualified teachers. The result of all this is that young people are hardly prepared for the next step in education. This leads to high dropout rates with a large number of young people who have no or little education. The low supply of unskilled work cannot cope with the high influx of unskilled young people. The result is high youth unemployment.

With the analysis of Mediterranean climate and completion of the Mahogany tables, a number of guidelines emerged that have to be taken into account in the design of the complex. It is recommended to build compact. In addition, it is important that the inner spaces are open for ventilation, however, with protection against wind and rain. Ventilation is needed as a permanent provision for airflow designed to provide cooling in the warmer periods. For the airflow, it is important that the building consists of rooms with a permanent facility for ventilation. The openings in the outer walls may be of medium size, this means 20-40% of the façade of the gross floor area.

The **materials** as containers, timber, concrete, clay, straw, sandbags, building blocks like compressed stabilized earth blocks are examined for suitability for self-construction and transition.

In the start-up stage, it is important to put an accommodation in quickly, where the first lessons can be given. The use of containers is one of the most obvious choices of material and construction method for this phase. At this stage, the speed of construction is outweighing the participation of students in the process. Participation will be limited to simple techniques because students have no knowledge and skills gained yet.

In all phases, different building materials are used, preferably local materials because the community is familiar with these materials and also from a cost perspective.

For the development and professional stage, practically all the materials suit. An affect on the final choice may be the availability on location and the costs to get to any additional materials to the construction site.

The degree of suitability for self- construction varies. Eco beams, sandbags with a wooden frame, Compressed stabilised earth blocks and also Straw Light Clays are labour intensive production methods, but very suitable for self-construction. The level of difficulty to apply is dependent of the construction, such as a roof construction which requires knowledge, skills and experience to make. Therefore most of these materials are more suitable for the development and professional stage.

CHAPTER 4

DISCUSSION



4. DISCUSSION

One of the key points of the research is that young people lack knowledge and skills that match the needs of the labour market.

The challenge in this project is especially to get young people involved in the building of the complex without having a complete view on what will actually bring them to a perspective of self-development and future job prospects. A question not covered in this study is how to approach and select the youth of Lavender Hill.

Which skills and educational programs will be offered to the students, are not part of the research but may eventually have an influence on the design of the complex.

The concept of this research is based on the assumption that there is economic viability of the complex. This, however, will only become apparent as the initial stage, the start-up phase, is realized.

Another observation concerns the chosen criteria of self-construction and transition and to which the materials and methods are weighed. The cost aspect is disregarded. However, this can of course have an impact on the final choice of materials and construction methods. The question can be asked whether it is therefore a complete research.

Within the research there was not enough time to do a more thorough analysis of the various materials and construction methods. A further deepening of the research might come to different views in terms of methods and materials used.

A comment can be made about the distinction that is made in several stages. The dividing line has been established between the different phases based on knowledge and skills without having identified which skills and level of experience must be required at different stages .

In the design fractals are used. The choice for fractal shapes in the design is dictated by a personal preference. Initially, it was tried to incorporate the choice of fractals in the research objective. This led to a lengthy search for relevance for the main research question. Finally the outcome was that there is no relevance and therefore fractals are left out of the research part of this theses. As fractals are used in the design as a personal preference, the use of fractals is described in appendix 3.

The construction of the entire complex is not a stand-alone activity, but depends on many factors, for example building codes, (local) laws and regulations regarding construction in townships. The design would therefore have to be adjusted if it appears that there are conflicting issues.

CHAPTER 5

RECOMMENDATIONS



5. RECOMMENDATIONS

- A. Additional research should be done into how the youth of Lavender Hill must be approached and selected for the project.
- B. Additional research is also desirable to identify what the Curriculum of the school should be and what the consequences are for the design.
- C. The design must also receive further technical details.
- D. The distinction between the different phases requires more depth into the distinctive criteria.
- E. It is recommended to add a financial section in the study containing a thorough research into the budgetary and financial aspects of the construction and how these can be financed.
- F. It is recommended to do an extensive research on the applicable building codes and regulatory requirements.
- G. Within the research there was not enough time to do a thorough analysis of the various materials and construction methods. This could still lead to a further deepening of the research thus might come to different views in terms of methods and materials used.
- H. Furthermore, a key recommendation is to investigate how control and management of the complex will take place and under whose responsibility the project is established.

CHAPTER 6

REFERENCE LIST



6. REFERENCE LIST

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