



# Assessing Namibia's STEM Education: focusing on the primary level

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**WPI**



**NAMIBIA  
UNIVERSITY  
OF SCIENCE AND  
TECHNOLOGY**

# Assessing Namibia's STEM Education: focusing on the primary level

An Interactive Qualifying Project  
submitted to the Faculty of  
WORCESTER POLYTECHNIC INSTITUTE  
in partial fulfillment of the requirements for the  
degree of Bachelor of Science

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Date:  
12<sup>th</sup> October 2018

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## ABSTRACT

The Namibia University of Science and Technology has low rates of enrollment in STEM majors. This project sought to identify factors inhibiting Namibian students' pursuit of STEM higher education through surveying university students, observing primary STEM classrooms, and interviewing primary-level educators. Our findings suggest that while STEM exposure at the primary level is important, low resource availability restricts STEM primary education in Namibia. Therefore, we developed basic STEM lessons for primary classrooms that use readily available resources.

## ACKNOWLEDGEMENTS

Our group would like to graciously thank the following individuals and organizations for their assistance and support throughout our project:

- Maurice Nkusi, our project sponsor, and Geoffrey Shakwa of the Namibia University of Science and Technology Teaching and Learning Unit for providing us with the tools we needed to be successful.
- UNESCO, for meeting with us to discuss the results of our project and for supporting the Kopano platform.
- The Ministry of Education, specifically Ms. Eva Asheela, Chief Education Officer of NIED, for providing us with the topics for our lessons and giving us insight on the Ministry's goals for the outcome of our project.
- Creighton Peet, Nicholas Williams, and Seeta Sistla, our project advisors, who were dedicated in their efforts to provide guidance and feedback and help our project grow.
- The principals, teachers, parents, and students of the Amazing Kids Private School and Academy and the Namutuni Primary School for welcoming us, and our research, into their schools.
- The students of the Namibia University of Science and Technology for participating in our surveys and allowing us to collect our research data.
- Varde Daniel Simaneka, Manfred Situmbeko, and Luise Shikongo, students of NUST, for providing valuable cultural insight and pre-testing our student surveys.
- University of Oregon for providing us with the open educational resource content to build our lesson plans.

## AUTHORSHIP

Carla Duarte, Matthew Jankowski, Christopher Tillotson, and Emily Wilson all contributed to the research and writing of this paper. While each section had its specific original author, all sections were discussed and revised by each member of the team.

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## LIST OF ACRONYMS

<b>CPD</b>	Continuous Professional Development
<b>NIED</b>	National Institute for Educational Development
<b>NMoE</b>	Namibia Ministry of Education
<b>NUST</b>	Namibia University of Science and Technology
<b>SES</b>	Socioeconomic Status
<b>STEM</b>	Science, Technology, Engineering, and Math
<b>TLU</b>	Teaching and Learning Unit
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>UNICEF</b>	United Nations International Children's Emergency Fund

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## EXECUTIVE SUMMARY

Despite being Namibia's flagship Science, Technology, Engineering, and Math (STEM) University, the Namibia University of Science and Technology (NUST) currently has low rates of enrollment in STEM majors (NUST, 2017). The goal of our research was to understand the factors inhibiting the pursuit of STEM higher education in Namibia. The Namibia Ministry of Education (NMoE) and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) hypothesized that the primary level was a necessary starting point to transform STEM education in Namibia. To address primary level education, the NUST Teaching & Learning Unit (TLU) has developed an online learning platform for teachers in Namibia called Kopano that aims to increase the exposure of primary school students to STEM. The NUST TLU asked that we create three online lessons to pilot the platform. In order to inform our Kopano lesson development and create recommendations for our stakeholders, we sought to identify:

1. The motivations behind NUST students' selections of their major
2. The current way in which STEM education is taught at the primary level in Namibia
3. Areas for improvement regarding the current student STEM experience at the primary level in Namibia
4. Areas for improvement regarding the current teacher experience and STEM training at the primary level in Namibia

There are many factors that could be affecting STEM interest and exposure in Namibia, which include: *the diversity of languages in the country; the rural nature of much of the population; the economic success of certain non-STEM industries; and the influence of primary level classrooms and educators.* To create effective lessons, we sought to identify the extent to which these factors influence students in their pursuit of STEM higher education.

We completed our research by surveying NUST students, observing primary STEM classrooms, and interviewing primary level educators. The NUST student surveys allowed us to analyze the development of factors which inhibit or promote the success of students in their pursuit of STEM higher education. We conducted our observations and teacher interviews at the Namutuni Primary School (a public school) and the Amazing Kids Private School and Academy (a private school). We used classroom observations to assess the current state of STEM education at the primary level. From our assessment of the primary school classrooms and NUST student responses, we created a set of recommendations to promote STEM education to students in Namibia.

### Results

We used the NUST student surveys to identify factors that were driving student choice of major. We found that:

- STEM majors identified passion as the largest influence on their choice of major. No STEM majors attributed growth of industries or economic success to why they chose their major, however, non-STEM majors did.
- Some non-STEM students accounted that they had a weak foundation in either math or science, which did not encourage them to pursue the subjects further.

- Both groups of students commented on the effectiveness of STEM opportunities outside of the classroom. STEM majors commented that these external STEM opportunities positively impacted them, while non-STEM majors said access to these opportunities could have potentially changed their career paths.

We used classroom observations and teacher interviews to identify the current state of science and math classrooms. We found that:

- Students at both the Namutuni Primary School and the Amazing Kids Academy were generally performing below their teacher's expectations in math. Teachers attributed this to a weak foundation from previous grade levels.
- Labs and classroom activities at the Namutuni Primary School were negatively impacted by a lack of funding and resources, while the Amazing Kids Academy was equipped with an abundance of resources. This inhibited teacher success and student exposure to STEM at the Namutuni School.

Overall, our findings showed that we must focus on the effective exposure of STEM to students at the primary level and beyond. Our NUST student interviews confirmed that if the challenges at the primary level are not addressed, they will continue through to the secondary level. Our findings also showed that it was necessary to incorporate labs which leverage accessible and relevant materials into the Kopano lessons, and to provide suggestions to schools regarding ways to expose students to STEM and strengthen their educational foundations.

## Recommendations

In order to further promote STEM education to students in Namibia, we have developed a list of recommendations based on the results from our surveys, classroom observations, and stakeholder input.

1. **Increase student exposure to STEM through external educational opportunities.** We recommend increasing student exposure to STEM outside of the classroom to spark student interest and help them develop a passion for STEM subjects. Our research showed that extracurricular activities influenced students to pursue STEM higher education. These events can show students the practicalities and relevance of STEM in Namibia. Although creating STEM exposure activities, such as career fairs, guest speaker events, and extracurriculars may be costly and time-intensive, schools may be able to mitigate these costs by collaborating with one another to create successful events.
2. **Promote collaboration between public and private schools in Namibia.** Private schools are equipped with an abundance of materials which allows them to focus on educating their students. We recommend that public and private schools collaborate by taking advantage of the cluster system that is already in place. Private schools could host STEM workshops and activities open to public school students, and teachers could come together to discuss their different teaching methods and experiences. Creating a bridge between the two school systems would increase the number of resources available to public schools and the overall STEM exposure of students.

- 3. Explore the current STEM education climate in additional primary schools and secondary schools.** Our investigation into the STEM primary school classroom climate was limited in that we only had two case studies. We recommend more classroom observations and teacher interviews at the primary level to increase the insight NUST and UNESCO have on the current state of classrooms throughout Namibia. Many students in our NUST student surveys mentioned secondary school as having some impact on their educational decisions. We also recommend further investigation into the STEM teaching methods, student experiences, and teacher experiences at the secondary level to reveal areas in need of improvement.

We anticipate that the development of our Kopano lessons and the recommendations we have made to our stakeholders can serve as catalysts in promoting STEM education in Namibia.

## CHAPTER 1: INTRODUCTION

At the Budapest World Conference on Science in 1999, it was stated that "*Science education, in a broad sense, without discrimination and encompassing all levels and modalities, is a fundamental prerequisite for democracy and for ensuring sustainable development*" (UNESCO, 2009). Science, Technology, Engineering and Mathematics (STEM) education and successful STEM industries are required not only to solve national issues, but to maintain global relevance in a technologically advancing world. Yet, countries often face challenges in achieving fundamental educational goals for all due to a suite of social and technical factors.

Although the factors that affect how STEM education materializes are often locally specific, research from around the world has identified: *education quality and cost, gender, family characteristics, student interest, and geographic dispersion* as particularly important for understanding exclusion and under involvement of countries and population subsets within STEM education (Bybee, 2013). These factors all contribute to the various ways students engage in STEM educational experiences, and they have been seen to inhibit or promote STEM involvement.

Many organizations have been working to bolster STEM involvement globally by addressing these factors. These efforts increase STEM access and involvement to underrepresented groups by leveraging online learning, hosting STEM workshops and camps, as well as increasing funding to schools and organizations. For example, Oregon State University (in the United States) created free lessons for teachers that are available online to increase access to free STEM educational content (STEM, 2018). Destination Imagination is a globally available program that was created to provide opportunities for students to be exposed to STEM through workshops and camps (Destination, 2018). These programs have been effective in exposing students to STEM education in the countries they have been implemented in. Yet, global problems still exist in STEM education because there are a multitude of factors which are deeply rooted in different countries' cultures.

One of the most prominent organizations working to improve STEM education access is the United Nations Educational, Scientific, and Cultural Organization (UNESCO) (2009). UNESCO chose 10 countries to focus on the improvement of STEM education, which included Namibia. In Namibia, UNESCO identified insufficient STEM exposure at the primary level as a key area in need of improvement, citing educators' lacking STEM subject matter knowledge and educational resources as particularly limiting factors (UNESCO, 2013). Therefore, UNESCO has partnered with the Namibia Ministry of Education (NMoE) and the Namibia University of Science and Technology (NUST) to address this problem. NUST is particularly hopeful to see progress made on STEM education at the primary level. Despite being Namibia's flagship science and technology University, NUST currently has more students enrolled in non-STEM majors than STEM majors (NUST, 2017). NUST believes that improving STEM education at the primary level will change this balance in the future.

The goal of our project was to develop online lessons that primary school teachers can use to increase their subject matter knowledge in STEM fields. These lessons are designed to assist teachers in providing STEM exposure to students and promoting students' future interest in STEM fields. Further, our research goal was to better understand the factors limiting the growth of STEM higher education in Namibia to inform the development of our lessons. Through our research, we sought to identify:

1. The motivations underlying NUST students' selections of their majors;
2. How STEM education is taught at the primary level; and
3. Areas for improvement for both the student and teacher experiences at the primary level.

This information will increase awareness of what steps are necessary to create impactful STEM lessons. Our research also guided recommendations regarding future initiatives of the partnered organizations: NUST, NMoE, and UNESCO.

## CHAPTER 2: BACKGROUND

In this chapter, we provide context necessary to understand the potential barriers to STEM education in Namibia. We begin with a brief overview of STEM's relevance globally and elaborate on the factors that influence involvement in STEM education both worldwide and in Namibia. Next we introduce the involvement of NUST, UNESCO, and NMoE in bolstering STEM education within Namibia. We conclude by synthesizing best practices related to professional development of primary school STEM educators as recommended by the aforementioned organizations.

### Relevance of STEM Worldwide

The National Science Foundation of the United States coined the expression “STEM” in 1990 as a way to discuss “Science, Technology, Engineering, and Mathematics” education and industry (Bybee, 2013). This buzzword has been used in many countries by everyone from politicians to curriculum developers as a catalyst for discussing scientific innovation or industrial development (Corlu, 2014).

STEM education is a main pillar of innovation and tends to positively correlate with individual standards of living, a country's ability to maintain global relevance in an increasingly technological world, and other societal benefits (Atkinson, 2010). STEM development facilitates societal progress through its ability to transform sectors such as security, communication, transportation, healthcare, and other topics of universal interest in any country (Kennedy, 2014). Further, a STEM-literate workforce capable of completing infrastructure projects and manufacturing goods helps to prevent countries from being forced to outsource specialized and often high-wage jobs, thus working to prevent over-dependence and exploitation (Prasad, 2005).

Any country wishing to reap the benefits of a STEM-literate workforce must first prioritize the STEM education of its students (Zollman,). For countries without a strong history of STEM education, this task poses particular challenges (Bybee, 2013). Even countries that are developed in STEM, have ongoing issues that often inhibit STEM's prominence and progress, highlighting the difficulty of developing and maintaining adequate STEM education.

### Global Factors Affecting STEM Education Involvement

While STEM is a key factor in advancing society, it is also considered a realm of exclusion and under involvement (Zollman, 2012). These factors are not limited to any specific group or country – they exist everywhere in the world and affect millions of people.

One of the most prevalent forms of STEM field exclusion is gender-based exclusion. Evidence for this claim exists in many studies, including a study conducted in Ghana. In this study, Boateng (2017) found that many women were denied higher education in STEM fields because of their gender. Boateng hypothesized that this exclusion is due to longstanding patriarchal norms that exist in Ghana. Similarly, women in the United States hold only 20% of STEM jobs, and only 25% of college-educated STEM workers are female (Noonan, 2017). In the U.S., women have historically held the role of homemaker, while men dominated the workforce (Degler, 1980). This has led to a lack of role models for women in STEM and an issue of gender-stereotyping (Beede et

al., 2011). In both cases, gender-based exclusion is the product of longstanding societal conventions.

Many researchers focus on gender when analyzing a students' choice to enter the STEM field, however, race-based exclusion is also a prominent issue in STEM education (Alegria, 2015). In the United States, racial minority students receive fewer Bachelor's and Master's degrees than whites (National Science Foundation, 2011). Additionally, racial minorities hold far less representation in STEM industries than the white population in the U.S. As of 2015, there were 17,842,000 White Americans employed in science or engineering jobs, while there were only 1,716,000 African Americans employed in these fields (National Science Foundation, 2011). Similar to gender-based exclusion, racial exclusion is not always deliberate, but can rather be a product of other factors. One example of this is when the circumstances in which a minority child grows up limit their exposure to STEM or their opportunities to pursue higher education (National Science Foundation, 2011).

Socioeconomic status (SES) is another factor that can drive STEM education exclusion. SES is defined by a person's income, education, and occupation in relation to others. For students, their SES is most often determined by their family, as many students have not yet established their place in society. A study by Niu (2017) showed that students with low SES were disadvantaged in their pursuit of STEM majors. Additionally, the study demonstrated that high SES tended to compensate for other factors such as gender and race in STEM major pursuit. A student with low SES may be well qualified to pursue STEM higher education, but may not take the opportunity because they cannot afford the costs associated with higher education. This issue exists not only among certain countries, but within countries. Socioeconomic segregation in the United States has caused educational inequality (Gamoran, 2017). Students who grow up in urban areas are more likely to be exposed to STEM than those in rural areas (Baker, 2015). While factors of STEM exclusion exist globally, every country's experience in promoting STEM education is unique. To successfully bolster STEM education, each country must identify and address the individual factors present in their society.

## Factors Affecting STEM Exposure in Namibia

One country that is struggling with some of these global factors is Namibia. Namibia gained its independence from South Africa in 1990 and its focus on bolstering STEM education is growing (United States Agency, 2006). Prior to this, *"the education system... was one designed to reinforce apartheid rather than provide the necessary human resource base to promote equitable social and economic development"* (United States Agency, 2006). Since its independence, Namibia has made great progress in strengthening its country's education system. Education is now universally accessible, despite the effects of the apartheid in dividing the country. Though progress has been made, Namibia continues to face deficits in STEM fields. In addition to the global issue described above, factors that are hypothesized to be affecting STEM interest and exposure in Namibia include:

1. The diversity of languages in the country;
2. The rural nature of much of the population;
3. The economic success of certain non-STEM industries; and
4. The influence of classrooms and educators.



## Regional Influences and Industries

Namibia's population is comprised of many ethnic groups and tribes, which speak a variety of languages. The Ovambo tribe makes up 50% of the population, while the next largest group is the Kavango tribe, which makes up 9% of the population (Central Intelligence Agency, 2018). The other 41% of the population is comprised of the Herero/Himba, Damara, mixed race or Coloured, White Namibians (Afrikaner, German, British, and Portuguese), Nama, Zambezi, San, and Tswana. This cultural variation could be causing language to be a barrier for those seeking higher education. Although English is the official language of Namibia, it is the native language of only 3.4% of the population. There are as many languages in Namibia as there are ethnic groups. When children go to primary school, they are taught in their mother-tongue until grade four (J. Asino, personal communication, August 28, 2018). Once a child transitions to senior primary school, the classes are taught in English, making it difficult to transfer certain concepts into a deeper level of understanding. The relevance of concepts quickly dissolves under the pressure to become accustomed to a new language (Teacher 9, personal communication, September 4, 2018).

Namibia is one of the least densely populated countries in the world (Country Comparison, 2018). Due to the sparse population pattern, it is difficult to identify what influences or motivates certain regions whether to pursue higher education. While agricultural land accounts for 47.2% of Namibia, only 1% of that land is considered arable due to the hot, dry climate (Central Intelligence Agency, 2018). Two-thirds of the population live in rural areas, and a majority of this population relies completely on their own farming as a source of food. In drought years, food shortages become an issue to those living in rural areas. Thus, not only is the exposure to STEM industries limited to this rural population, but there is little relevance in the pursuit of STEM higher education where subsistence lifestyles dominate. This population's priorities lie in survival and not in what is influencing urban areas.

When selecting a career path, the economic success of an industry can be influential in the decision making process. Job security relies heavily on a few factors: *that the industry is stable, that your skills qualify you for the position, and that the job is available in the first place*. The top five industries in Namibia (based on percentage of the population employed) are Agriculture, Forestry, and Fishing; Wholesale and Retail Trade; Construction; Private Households; and Manufacturing (Namibia Statistics Agency, 2017). These industries employ 54.4% of the population and they remain in the 38th percentile of average wages. This is a reflection of the skill-level required to enter these industries. Unlike in pursuing STEM jobs, it is not typically necessary for Namibians to complete higher education to enter these industries. To Namibians, these jobs may appear to hold a higher level of practicality, providing both opportunity and security.

The nature of the growing unemployment rate in Namibia points to the influence of industry when a student is choosing their major. The country's unemployment rate is currently 34% and many of the unemployed population resides in rural areas (National Planning Commission, 2018). As employment in the Agriculture, Forestry, and Fishing industry continues to decline, so do the opportunities for those living in rural areas. This creates a new gap that could potentially be filled by growing the STEM sector. Although shifting employment possibilities might motivate rural students to pursue higher education in order to secure a job in another industry, 70% of the unemployed have not passed the junior secondary level of education (National Planning Commission, 2018). Unemployed youth are not returning to school to further their opportunities



because they may not see a relevance of attending school to secure jobs outside of the industries they are accustomed to pursuing.

The current STEM job opportunities in Namibia are not accessible to the majority of the population. One roadblock is the exceptional burden students must face to access higher education. On the other hand, infrastructure must exist to support these students once they pursue STEM higher education. Currently, 2.3% of the population is employed in industries which directly relate to STEM (National Planning Commission, 2018). If job security is not guaranteed for students once they graduate, they may not see the relevance of pursuing such a field. Unless there is growth in STEM industry opportunities in Namibia, this unbalanced ratio will likely persist. Namibia has the potential to restructure its labor force by utilizing a larger STEM workforce. However, the STEM industry and the exposure of students to STEM must grow simultaneously because one cannot be effective without the other.

## Education in Namibia

Educators worldwide have identified a need to improve STEM education in the classroom to cultivate STEM growth. For example, in 2015, Australian Prime Minister Turnbull announced an allocation of funds to boost STEM education in schools (Hunter, 2018). It was noted that "*STEM education in Australia won't [realize] its full potential unless [they] address issues of resources, equity, teacher professional learning, the needs of students who speak English as an additional language and may have low literacy and numeracy skills, and aging school facilities*" (Hunter, 2018). Studies conducted in Australia showed that when a 10-week unit of STEM education was implemented to address these factors, students were eager to learn and teachers were confident in building their STEM subject matter knowledge and teaching more difficult topics (Hunter, 2018). The Namibian education system must address similar factors to improve their current state. Overcrowded classrooms, limited curriculums, and absence of funding are issues in the primary schools of Namibia (National Institute, 2016a).

Both public and private schools exist in Namibia; however, public schools face a majority of these issues. For example, the Namutuni Primary School is a public school located in Katutura, a township of Windhoek, Namibia. The school has a total population of around 960 students spanning junior primary (pre-primary to 3 grade) to senior primary (4 grade to 7 grade). The large class sizes (~40 students per classroom) create challenges for teachers in ensuring that each child is performing as they should (J. Asino, personal communication, August 28, 2018). Likewise, physical materials and financial resources are limited due to low government funding. Namibia provides N\$100 (\$6.94 USD as of August 2018) per child up to 3 times a year. The Namutuni School only received this allocation once this calendar year. Teachers at the school also voice concerns about the relevance of curricula (Teacher 9, personal communication, September 4, 2018), as students have a difficult time relating to the material they are learning. Although science and math subjects are included in the curriculum from pre-primary to grade 11, students are underperforming in these subjects, and they are especially unprepared once they reach higher levels of education.

Another concern of the school is student attendance levels (Teacher 4, personal communication, September 5, 2018). Unfortunately, one thing that can affect the students' attendance is HIV/AIDS. HIV/AIDS is a prevalent disease within Namibia that affects 230,000 people (Central Intelligence Agency, 2018). If a child's parent has the disease or has passed away, it can limit their ability to support them at home or even take them to school. Likewise, if the parent



Figure 1: Image Showing the Condition of Desks and Workbooks at Namutuni Primary School

has passed the disease down onto the child, the child will attend less school due to the effects of the illness. At the Namutuni Primary School, low attendance levels due to the effects of this disease have surfaced. Teachers at the Namutuni School expressed their concerns about attendance rates impacting student performance levels (Teacher 4, personal communication, September 4, 2018). This is not a concern limited to the Namutuni Primary School; the effects of this disease have been witnessed throughout Namibia. UNICEF (United Nations International Children's Emergency Fund) created a five-day math and physical science program for grade twelve girls to learn and interact with one another regarding STEM topics (Gathercole, 2002). Regarding the program, they said

*"Everyone we spoke to saw the need for the project, and were enthusiastic about its success. However, it was not enough to give academic support while ignoring the social context which makes young women vulnerable to teenage pregnancy, domestic violence, and HIV/AIDS"* (para. 9).

The second school involved in our study is the Amazing Kids Private School & Academy, a school located in Windhoek that is privately funded. Because the Academy does not rely exclusively on the government for their funds, it is able to control classroom sizes (~20 students per classroom) and teacher quality more than a public school.

While students who attend private schools tend to come from more privileged backgrounds, these students are not immune or unaware of the reality of their surroundings. Alcoholism is a major problem in Namibia, and when children are exposed to this in their families early on, they can be influenced to repeat these behaviors in their own lives (Pendleton, 1996). The director of the Amazing Kids Academy, Emma Kakona, has identified a link between alcohol abuse, drug abuse, behavioral issues, and poor classroom performance at the school (Kapitako, 2017). Students at the Amazing Kids Academy are tested for drugs and counseled accordingly. If students are being

distracted by drugs or alcohol, it can be difficult to encourage them to turn their focus back on receiving an education. Regardless of STEM exposure in the classroom, if this factor is inhibiting a students' education, teachers and parents must prioritize addressing the issue.

Teachers are the closest connection to influencing students' educational experiences. Knowing this, UNESCO (2009) states that “*Teachers are the key players in improving the learning of all our children in school*” (p. 37). Overcrowded classrooms, limited resources, and absence of funding also pose serious issues for teachers in Namibia. Even if teachers within the same school are able to discuss how to improve their situations, they are limited to their available resources. Namibia has implemented a cluster system, where schools are geographically organized into clusters to share resources and ideas (Dittmar, Mendelsohn, & Ward, 2002). These clusters were created with the intention of allowing teachers to get together and avoid isolation, which is a common phenomenon in Namibian schools. Classrooms throughout Namibia are quite different in regards to access to resources and funding, but their curriculum is unified. Further, although 88% of teachers in Namibia are considered qualified to teach their subjects, they still have problems in molding the curriculum to be relevant to the students and finding solutions to the problem of limited resources (Wils, 2012). This leads to teacher burnout which inhibits teacher success, in turn affecting the students' comprehension and interest levels for science and math (George, Louw, & Badenhorst, 2008). Although the clusters seem to allow teachers to share ideas, it is not a support network where teachers can receive formal in-service training. If teachers are better equipped in a formal manner, they can address the problems of curriculum relevance and the underperformance of students due to limited interest.

## Partners in Improving STEM Education in Namibia

There are multiple organizations who have worked in Namibia to increase teacher subject matter knowledge. NUST, UNESCO, and NMoE have partnered to improve STEM education and exposure.

### Namibia University of Science and Technology (NUST)

NUST (2018) is one of the first institutions of higher learning to exist in Namibia. Previously known as the Polytechnic of Namibia, it was established in 1994, when it became the second official university in Namibia. Since then, NUST has been striving to provide quality education for all of its enrolled students. They have also made great strides in improving overall STEM education in Namibia.

While NUST was designed to be the premier STEM institution of Namibia, it has been working towards attracting a greater number of STEM students to its programs (NUST, 2017). Currently there are 4,254 STEM major students at NUST, and 6,972 non-STEM majors. This balance between STEM and non-STEM majors is not a new challenge for NUST, as non-STEM majors have always held the majority of students (Figure 2). Over the last decade involvement in STEM has increased slightly, however, these numbers are not at the level which NUST aspires to reach.

## ENROLLMENT IN STEM VS. NON-STEM MAJORS BY YEAR

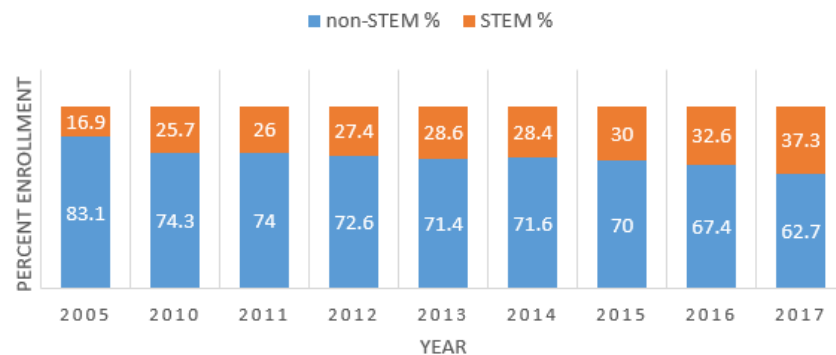


Figure 2: Percentage of STEM and Non-STEM majors at NUST between 2005 and 2017 (NUST, 2017)

The school's vision statement is, “*NUST is a premier university of science and technology preparing leaders for the knowledge economy*” (NUST, 2016). However, enrollment rates in STEM fields remain relatively low. If NUST can identify what is causing their STEM population to be low, the university can then start to find solutions to their STEM under enrollment problem.

### United Nations Educational, Scientific, and Cultural Organization (UNESCO)

UNESCO is working with NUST's Teaching and Learning Unit (TLU) to address STEM education issues in Namibia. UNESCO is an organization that includes 195 member states working together to promote international collaboration to ensure that every child has access to quality education (UNESCO, 2009). They strive to provide lasting support to people and develop international standards and programs that share access to quality of education for all.

UNESCO (2009) stands by the notion that improving the quality of science education is important as many basic parts of life revolve around science. Science education can also be linked to the gap between the rich and the poor. “*The Declaration of Budapest argues that what [distinguishes] poor people or countries from rich ones is that not only do they have fewer possessions but also that the large majority remain excluded from the creation and the benefits from scientific knowledge*” (UNESCO, 2009, p. 10). Once a society can embrace scientific advancements which stem from access to education, the population as a whole can begin to benefit.

Even in developed education systems, UNESCO (2009) has found that science education is not well established in the classroom. UNESCO's (2009) studies have informed a pedagogy for how science education could be more effective for students. This included ensuring that: *the students' existing ideas were addressed and connected to their classroom experiences; the science learning was appropriately challenging; the teachers were educated in the subject; and the students are engaged*. UNESCO is working with the NUST TLU to find a solution in Namibia that encompasses this pedagogy as UNESCO identified that both the delivery of information and the quality of the educators is critical to STEM education success.



## Namibia Ministry of Education (NMoE)

The National Institute for Educational Development (NIED) is a branch of the Namibia Ministry of Education which is in charge of curriculum development, educational reform, and teacher development in Namibia (National Institute, 2016b). In their most recent annual report for the 2015-2016 year, NIED assessed the tools, equipment, materials, syllabi and curricula for STEM topics in primary and secondary schools. After assessing the current conditions, NIED worked on multiple projects to improve them.

NMoE has focused on reforming the science curriculum because they believe that natural sciences are key to transforming the world (National Institute, 2016b). They want their students to have the knowledge to ask questions, make observations, and understand the physical world in a scientific way. NMoE's goal is that once students

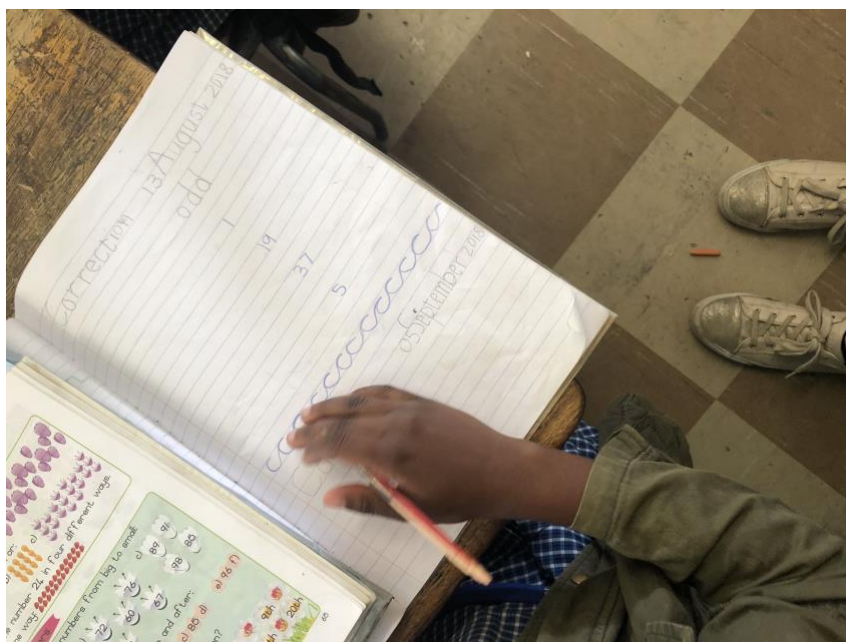


Figure 3: Namutuni Primary Student Working on a Math Exercise

have this knowledge, they can make healthy life choices, in turn improving their standard of living. One issue they have faced with this curriculum development, however, is the lack of funding to purchase the necessary materials to support the curriculum. According to Ms. Eva Asheela, the Chief Education Officer of NIED, NMoE has focused on curriculum development in the past and is now also establishing a focus on the professional development of educators and finding creative solutions to the issue of limited resources (personal communication, September 5, 2018).

## Professional Development

In a message from the former Minister of Education of Namibia, Hon Dr. David Namwandi stated, *“But what about the teachers who are to provide the stimulation and guide the learning of our young children? We [realize] now that most of the teachers who are deployed at this level of the education system have not been adequately prepared for their demanding role, and neither are they being provided with sufficient professional and material support”* (UNESCO, 2013). Teachers are the ones who are sharing the knowledge with their learners, so it is important that they are appropriately trained and equipped.

UNESCO (2009) believes that in order to improve the quality of STEM education, there must be a satisfactory quantity of capable teachers (p. 37). Developed countries usually do not have a problem securing a satisfactory quantity of quality teachers. Unfortunately, this is not the case for countries with limited resources. There is also the need to focus on the quality of educators. Teachers need support in attaining the knowledge required to promote this higher quality of STEM education (UNESCO, 2009, p. 38).

NMoE identified that in order to start improving STEM education in Namibia, the quality of primary education must be improved by enhancing teacher education and training (UNESCO, 2013). Continuous Professional Development (CPD) is key to ensuring that teachers are able to keep up with new information and curricula that are being introduced. Once teachers enter the workforce, in-service training is available to promote lifelong learning. One in-service program available to teachers is provided by The University of Namibia. The University's CPD unit offers short courses for teachers to take to enhance their knowledge. They also have a structured program for under-qualified teachers to bring their qualifications to an acceptable level. Because of the information and communication technologies available to NUST, they have partnered with UNESCO to develop a similar program through an online platform called Kopano to train teachers. Both the CPD unit and Kopano are aimed at providing in-service training to teachers, however, Kopano differs in its ability to be accessed online. Kopano allows information to reach teachers who are spread around the country, especially in rural areas through online lessons that help increase teacher subject matter knowledge and provide teacher support through discussion boards. The lessons on the website can be opened at any time, allowing the teachers to refer back to the information as needed. The platform was built to be user-friendly and can be updated frequently, allowing new information to be passed onto teachers rapidly.

NMoE identified three lessons to be tested on Kopano by leveraging open educational resources (OER). OERs are online resources which provide free access to educational materials. This allows collaboration between schools to promote education for all. The lessons that have been chosen were developed by Oregon State University. The three courses selected for testing were:

1. Understanding Batteries and Capacitors;
2. Solar City; and
3. Electrochemistry: Harnessing Electricity from Chemical Reactions

NMoE piloted the three courses at the Namutuni Primary School and the Amazing Kids Private School and Academy.

Addressing STEM education at the primary level has been clearly identified as a starting point to establishing a strong foundation in STEM. Investigation into the factors affecting student interest in STEM must be conducted to understand how to move forward in guiding the teachers in promoting STEM to students.

## CHAPTER 3: METHODOLOGY

The goal of our research was to understand the factors inhibiting the pursuit of STEM higher education in Namibia. While we recognized the variety of factors involved in the reduced number of participants in higher-level STEM education, we chose to focus our research on primary level education because we, as well as our stakeholders, considered it to be a tangible area for improvement. Ultimately, we used this information to guide teachers in promoting student exposure to STEM at the primary level. To achieve this goal, we developed and addressed the following research objectives:

1. Identify the motivations behind NUST students' selections of their majors.
2. Identify the current way in which STEM education is taught at the primary level in Namibia.
3. Identify areas for improvement regarding the current student STEM experience at the primary level in Namibia.
4. Identify areas for improvement regarding the current teacher experience and STEM training at the primary level in Namibia.

In this chapter, we describe the methodology we developed to gather and analyze the information required to create recommendations regarding the professional development of primary school teachers in the field of STEM.

### Objective 1: Motivation Behind NUST Students' Major

We sought to determine what motivates a student's choice to enroll in STEM versus non-STEM majors. Students are hypothesized to be influenced by a variety of factors including education, family dynamics, and geographic location (Wang, 2013). We sought to identify factors that affected students' enrollment, which gave us insight into the decision-making process of a Namibian student. To gather this information, we administered a structured survey consisting of close- and open-ended questions (Appendix B and C). The close-ended questions allowed us to gather quantifiable data, while the open-ended questions provided qualitative insight. The questions in the surveys identified:

- The major the student has chosen
- Past educational experiences that led the student to this major
- External factors that influenced their choice of major
- Whether the student was satisfied with the educational opportunities they were given

Our intention was to gather data from 20 male students and 20 female students; 10 non-STEM and 10 STEM majors within each gender. This population also allowed us to compare male and female experiences separately regarding STEM vs non-STEM majors. Two of our team members conducted purposeful convenience sampling on the NUST campus at a time. Random sampling of the population would not have been effective, as we were advised by NUST faculty and students that emailing, texting, or calling would be less likely to elicit a response because our communications would have been unsolicited (personal communication, August 28, 2018). They advised face-to-face contact as the best method of reaching students. We also administered a pre-test (Appendix C) to confirm that our questions were culturally relevant.

The team members spent three hours surveying on the lower campus where STEM-related buildings are located and another 3 hours on the upper campus where liberal arts buildings are located (Figure 4). This method was utilized to promote an even sample of both major categories. We were able to interview 22 STEM majors and 18 Non-STEM majors, with 20 female and 20 male students. The students' identities remained anonymous, and they were made aware that the nature of the interview was voluntary.



Figure 4: NUST Campus Map Highlighting Locations Where Students Were Surveyed

(NUST Campus Map., n.d)

While asking the open-ended questions, we recorded notes and later coded the responses to detect outliers and trends in the student experiences. We looked for related phrases and words that were brought up by multiple students. We also looked for trends in major, gender, and mother-tongue. We used analysis of categorical variables and frequency tables to examine our quantitative data, such as whether parent higher education, mother-tongue, or region of upbringing influenced major selection (Kerfoot, 2014).

## Objective 2: Primary Level STEM Teaching Methods

As exposure to STEM begins at the primary level, we sought to identify the teaching methods that currently exist for math and science in primary schools. We conducted our research in the Namutuni Primary School, a public school in Windhoek's Katutura District, and the Amazing Kids Private School and Academy, a primary and secondary school in Kleine Kuppe, Windhoek. Our sponsor at NUST, Maurice Nkusi, selected and facilitated contact with these two schools. This enabled us to explore the variation that exists between public and private primary institutions within Windhoek. We observed classrooms using a rubric (Appendix E, Questions 1-4) and conducted semi-structured interviews with teachers (Appendix D, Questions 1-3). We observed the



students rather than interviewed them because we believed we could gather more data through observation.

At the Namutuni Primary School, we observed two junior primary classrooms, which included math and science lessons, and 4 senior primary classrooms, 2 of which were math and 2 of which were science. We spent 4 hours in each of the junior primary classes, and the senior primary classes were 40 minutes each. The allotted time was based on their class schedule. We also interviewed the 2 teachers of the junior primary classes that we observed, and the 3 teachers that taught the 4 senior primary classes.

At the Amazing Kids Private School and Academy, we observed 3 junior primary classes, 2 of which were science and 1 of which was math. We also observed 3 senior primary classrooms, 2 of which were science and 1 of which was math. We spent 40 minutes in each class, which was based on their class schedule. The teachers and classrooms at both schools were selected on the basis that they were taught in English and taught a STEM subject. We utilized classroom observations and interviews with the teachers to identify:

- The labs/physical materials available for use in the classroom
- The science subjects included in the curriculum
- Whether different methods are being used to teach the different subjects of science

The administration sent out a notice to students' parents to inform them that their child could have been involved in the observations and to gain photographic consent (Appendix F and G). They had the opportunity to decline their child's participation. We were non-intrusive in our observations so that we were able to gather accurate information regarding the classroom environment. We accomplished this by communicating our goal of pure observation with the teachers. This reassured them that we were not there to evaluate them, but rather to observe their normal lesson plan. It was also important to limit the number of observers from our group to a maximum of two. This mitigated a disturbance in the classroom; however, we recognize that our presence was still a distraction and may have influenced teacher behavior.

We used a rubric to standardize our findings and guide our observations (Appendix E) (Kerfoot, 2014). We looked for trends in our notes and performed content analysis to evaluate our qualitative data from the teacher interviews. We performed content analysis by coding our notes and looking for repeated answers and patterns in the teachers' responses.

### Objective 3: Identify Ways to Improve the Current Student Experience

A student's interest level is also an issue that affects student involvement in STEM (Sithole et al., 2017). To evaluate how students are engaged in the STEM content that is taught at primary schools in Namibia, we gathered information on student performance and participation levels using a rubric (see Appendix E, Questions 5-6). We developed this rubric by discussing amongst ourselves the different aspects of our research questions and how we could identify effective education in the classroom. This included:

- Whether the students were asking questions that demonstrate engagement
- Whether the students were answering the teachers' questions to demonstrate engagement
- Whether the students seemed to understand the topic

We used our observational data, in addition to the information provided to us from our teacher interviews (Appendix D), to determine whether there was a correlation between student engagement in the classroom and student performance. We also identified what students enjoyed about the current lesson plans. Similar to our first and second objectives, we kept our observations as non-intrusive as possible. This was to minimize distractions in the classroom. Our observations were conducted in the current classroom environment. We followed the same protocol as stated in Objective 2 regarding classroom selection, parent permission, and data analysis.

## Objective 4: Identify Ways to Improve the Teacher Experience

Investigating the teacher experience at the primary school level assisted us in further understanding STEM education as a whole. UNESCO states that the role of teachers is important because they are most responsible for influencing students in education (2009). We hypothesized that if students had a bad experience with a science or math teacher, they may be less likely to join a STEM field. Because teachers play such an influential role, we identified whether they had the resources and knowledge necessary to teach STEM. Our interview structure allowed the teachers to identify areas in need of change. We utilized semi-structured interviews (Appendix D, Questions 4-11) to identify whether teachers:

- Feel prepared to teach their lesson plans
- Feel they have adequate resources to teach the lessons
- Believe that they have a good balance between structure and freedom in their lesson plans
- Have the necessary educational qualifications to teach primary school-level mathematics and science

Open-ended interview questions were developed with these research questions in mind. The questions we asked the teachers relative to this objective were addressed in the interviews we conducted in Objective 2. The teachers' identities were kept anonymous, and they were given the option to withhold participation. Each interview was conducted for about 15 minutes. Through content analysis of our findings, we were able to compare the different experiences. We recorded and analyzed our interviews in the same method described in Objective 1. The data collected provided insight into improving teacher subject matter knowledge and methods of exposure of STEM to students. It indicated where the gaps in knowledge are, what teaching methods students found engaging, and what external factors are influencing students' views on education.

## CHAPTER 4: RESULTS

This chapter reviews the results of our research at NUST, the Namutuni Primary School, and the Amazing Kids Private School and Academy. The goal of our research was to understand the factors inhibiting the pursuit of STEM higher education in Namibia. We did this by identifying:

- 1. The motivations behind NUST students' selections of their majors.*
- 2. How STEM education is taught at the primary level in Namibia.*
- 3. Areas for improvement regarding the current student STEM experience at the primary level in Namibia.*
- 4. Areas for improvement regarding the current teacher experience and STEM training at the primary level in Namibia.*

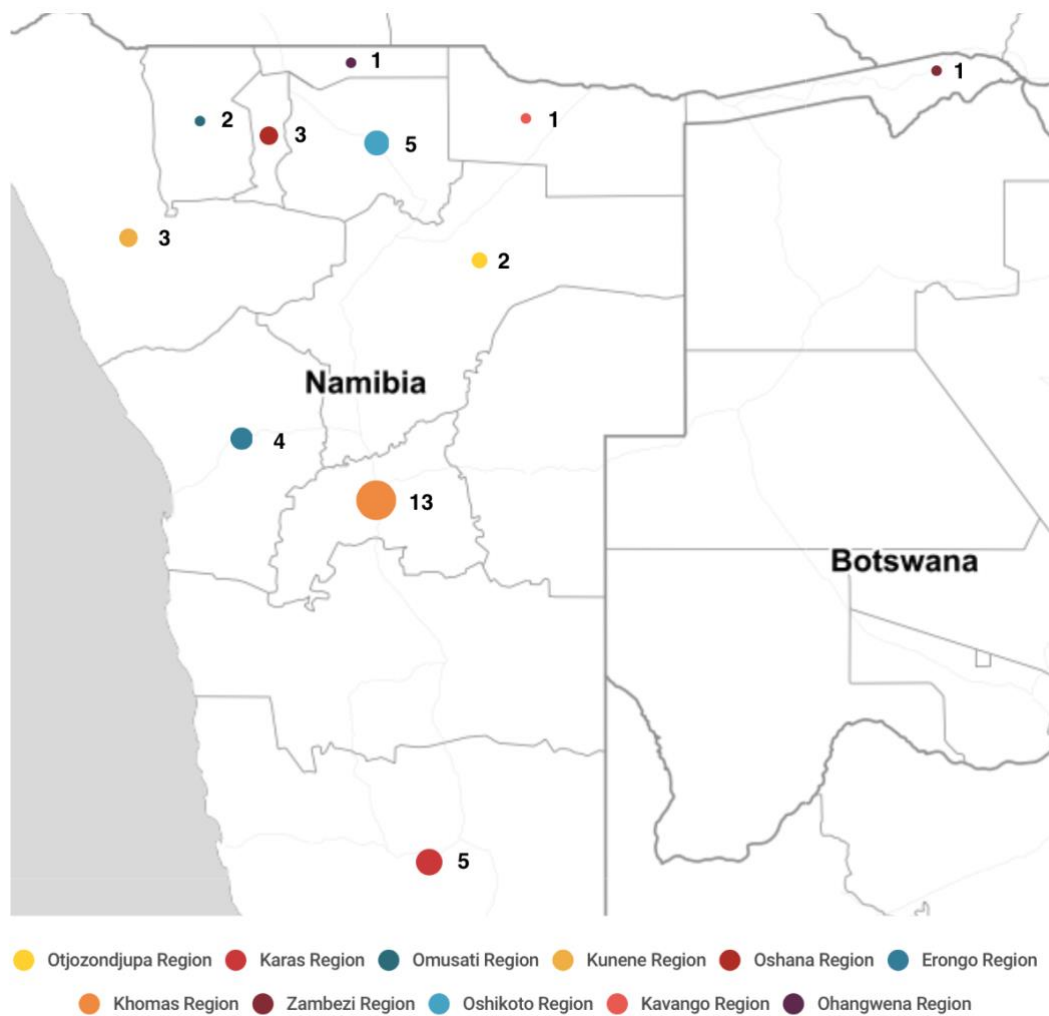
The findings from our research questions allowed us to guide teachers in promoting student exposure to STEM at the primary level, and to provide recommendations for the partnered organizations.

### Objective 1: Motivation Behind NUST Students' Major

We interviewed 40 NUST students to better understand why Namibian students selected their field of study. The results of the survey gave us insight that primary school played a role in their major selection and that it was a logical starting point in which to improve STEM education. Our findings also provided insight into external factors that affect students' motivations to pursue STEM higher education.

#### Demographic Information of Our Sample

Our sample consisted of 20 male students and 20 female students, with 22 of those students being STEM majors and 18 of them being non-STEM majors. The students came from 11 out of the 13 regions in the country (Figure 5). Many of the students came from the regions north of Khomas, which is a reflection of the geographic distribution of the population. A majority of the population resides in the northern regions of Namibia, while the two regions not represented have two of the lowest populations in Namibia (Wilhelm, 2015). Of the students who came from the Khomas region, all were specifically from Windhoek.



*Figure 5 : Map of region representation of the participants in our survey, with dot size corresponding to sample size of participants (N=40)*

The students' mother tongues, or first languages, followed a similar pattern to regional background. We were able to use the mother tongue of the student to inform which ethnic group or tribe they were a part. Of the 40 students interviewed, 50% of the students were Oshiwambo speaking (Figure 6). This again is representative of the population of Namibia, as 50% of the population is Oshiwambo (Central Intelligence Agency, 2018).

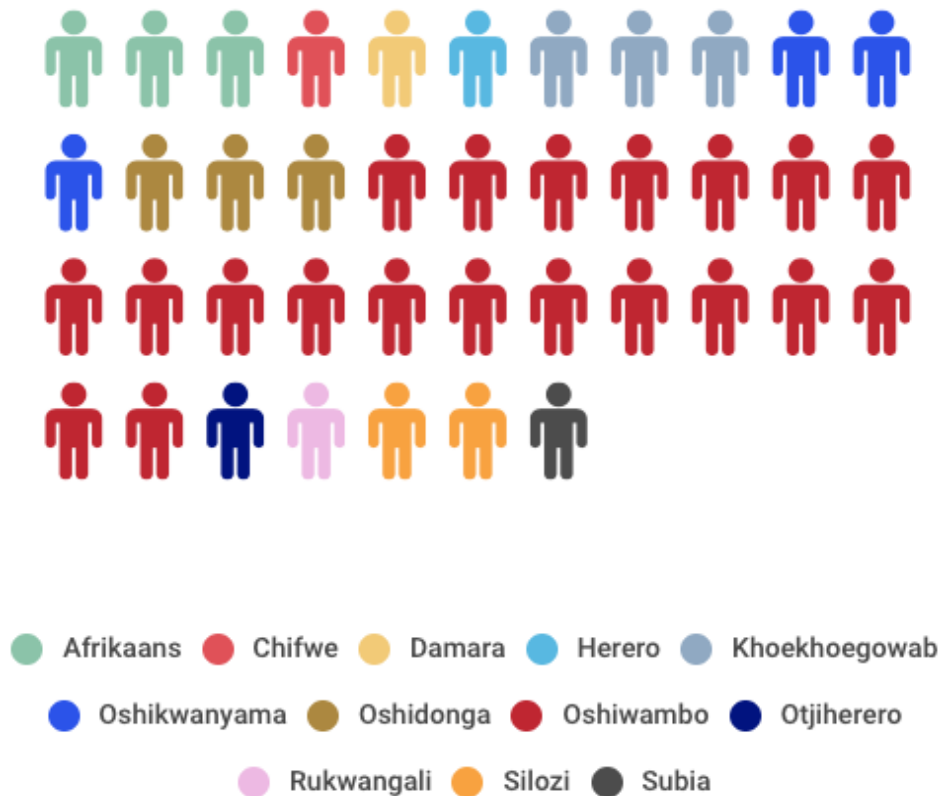


Figure 6: Primary languages of NUST student survey participants (N=40)

These demographics confirm that our survey population is a good representation of the population of Namibia. This shows us that the data we collected reflected the disparities within regions and ethnic groups across Namibia regarding educational influences. We acknowledge the limitations of our data as some regions have few or one participant responses.

### Factors Which Affected STEM Students' Choices of Major

In order to understand why there is a lack of STEM majors enrolled at NUST, we sought to identify what influenced students to enroll in a STEM major. We asked STEM students if there were any educational or external factors that affected their choice in major.

We found that STEM majors were more likely to say that they had some exposure to STEM. 9 STEM students who mentioned a primary school experience talked about how there was a lack of STEM resources in their schools and about the limited exposure to STEM subjects they received. One student said, paraphrased, “*There was not a good foundation for learning (in primary school), there was a scarcity of resources, and this caused me to not feel prepared for secondary school*” (Anonymous, personal communication, August 29, 2018). They also mentioned how they did not feel prepared to move on to the next level of education as they were not provided a strong foundation for continued learning. One student mentioned that he felt unprepared for higher education because his teachers were not prepared. Many students also attributed feeling unprepared to a lack of resources in earlier levels of education. Most students mentioned experiences in secondary school that affected their major choice. Of those who mentioned a secondary school

experience, many were influenced by a passionate teacher or an extended opportunity such as career fairs, after-school classes, or extracurricular activities. One student studying Computer Science stated that he was first exposed to working with computers through a computer class after school, and that drove him towards discovering his passion. Educational experiences, however, were not as prominent of a factor as other existing external factors for STEM majors.

When asked what external factors led our participants to choose their majors, many factors were identified including: family and friends, industry, community, media, and passion. Of the STEM majors we surveyed, none of them stated that they wanted to follow the same career paths as their parents. Further, most STEM majors did not have parents employed in the STEM industry (Figure 7); this may reflect the limited number of STEM job holders in the country. If family influence was mentioned, the student attributed their motivation to taking advantage of an opportunity that their parent did not have or that their family member wanted them to have. A majority of NUST student's parents did not attend higher education.

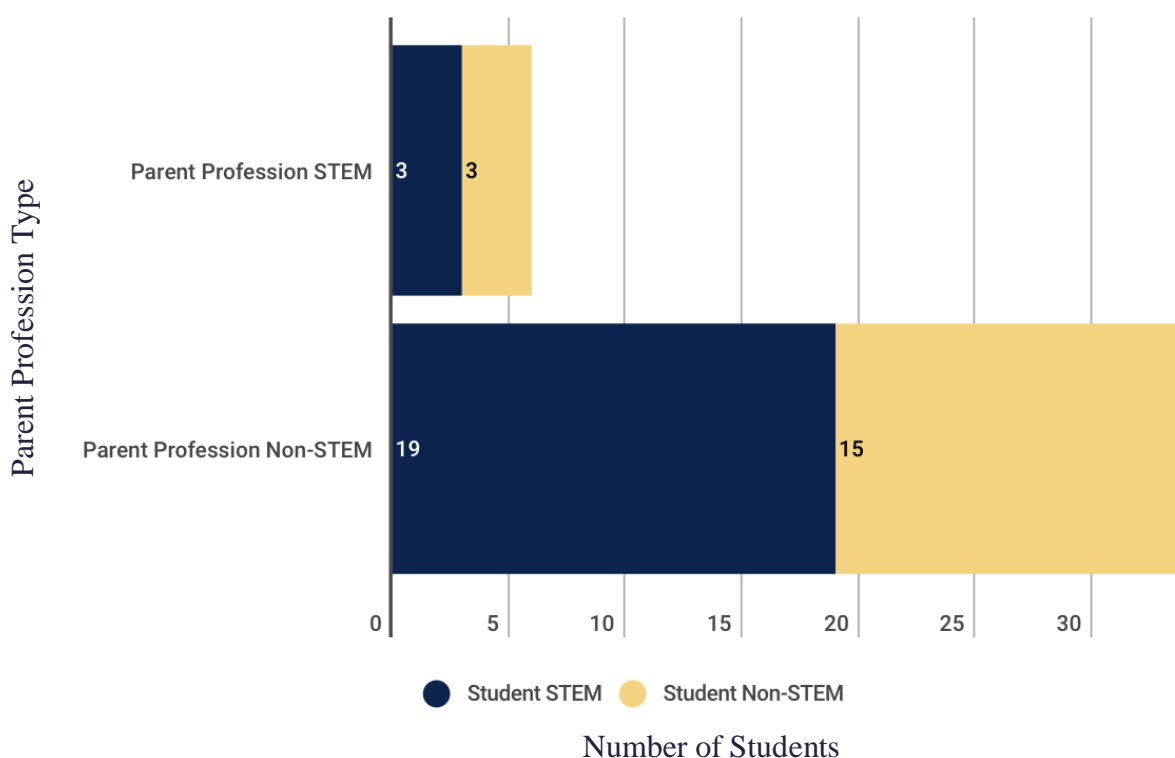


Figure 7: Parents' professions relative to student major (N=40)

No STEM major attributed the growth of a specific industry or the current state of the economy as an external factor that motivated them to choose their major (Figure 6). Those who identified their communities as an influence, wanted to apply their degrees to helping populations in Namibia and giving back to their community. However, the most frequently mentioned factor motivating STEM students' choice of major was having a passion for the subject (Figure 6). This suggests that they were exposed to STEM at some point (which may have included their time as a student at NUST) and that exposure got them so interested that they decided to further explore the possibilities.

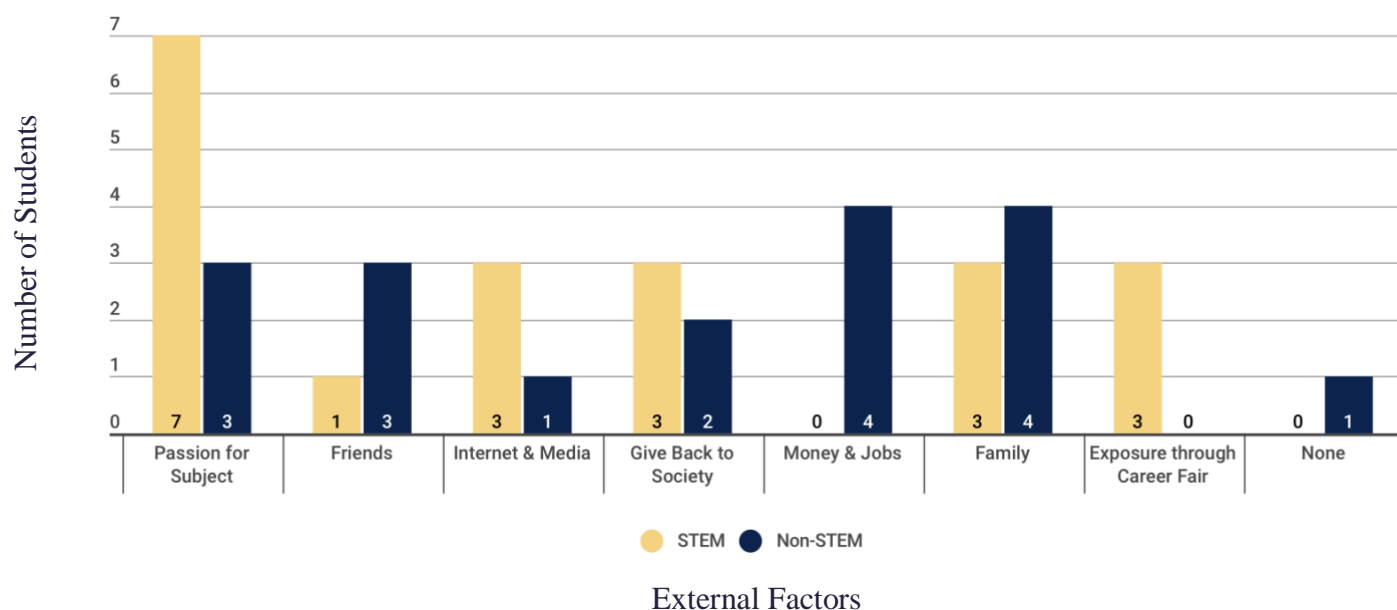


Figure 8: Student Reported Factors Influencing Major Choice

### Factors That Affected Non-STEM Students' Choices of Major

We also wanted to find out why students decided to study a major other than STEM. When non-STEM students were asked about an educational experience that affected their choice of major, many of them said they did not have one. Students who did mention an educational experience reported that their science or math experiences were negative due to an unmotivated or ineffective teacher, mainly at the secondary school level. Because of these experiences, some students became disinterested in STEM subjects. When asked about external influences that affected their choice, non-STEM majors mentioned many factors. Some non-STEM students commented on the success of their family members, friends, and money as motivators. One student from Luderitz studying Land Administration attributed his interest in his major to friends from home who were already in school for the same major. He accounted that some of his friends had jobs in land reform and that he found that interesting. Another non-STEM student attributed his motivation to the success of his mother's business and claimed that he too would like to own a business in the future. Non-STEM majors reported being influenced by the state of the economy and the growth of certain industries (Figure 8). One student studying Transport Management commented that he would like to own a transportation company in the future because "*transportation is big in Namibia*" (Anonymous, personal communication, August 29, 2018). This sentiment surfaced in other interviews with non-STEM students. Many students commented on the potential success of owning their own business in Namibia which does not require a STEM degree.



## Objective 2: Current Primary Level STEM Teaching Methods.

Our group observed classrooms and interviewed teachers at both the Namutuni Primary School and the Amazing Kids Private School and Academy in order to identify how STEM was being taught. We recognize a main limitation of our data collection is that we only have one example of a public or private school. It would be erroneous to try to generalize both types of schools in the country based on these two schools. Collecting insight from both schools, however, allowed us to create a relevant deliverable as the Namutuni School and Amazing Kids Academy would be the first to pilot the lessons. Overall, we found a stark contrast between the level of resources, curriculum, and teaching methods between the public and private school.

### Resources, Curriculum, and Teaching Methods at the Namutuni Primary School

At the Namutuni Primary School, educators, parents, and students did not have adequate resources to facilitate productive STEM learning. This became apparent in both our classroom observations as well as teacher interviews. Classrooms were typically lacking common educational materials such as textbooks, writing instruments, and hands on materials. Of the 5 teachers we interviewed, 4 noted that they lacked the proper materials to teach and had to find creative ways to supplement teaching supplies from cheap household items. The school had recently received computers and tablets to attempt to integrate technology into lessons, but this one computer lab would still be shared between 960 students. The school did not have any STEM focused labs to put theory into practice.

Parents living in Katutura, a low income area, often did not have the means to provide their children with the necessary school supplies. This was observed when students became distracted from their lessons when sharing materials such as pencils. Teachers appealed to students to ask their parents to buy them proper school supplies. Parent support was apparently lacking for some children at the school.

A National Curriculum is provided by NMoE for all Namibian schools, including Namutuni. All of the educators we interviewed indicated that they must teach lessons in accordance with the National Curriculum. Educators indicated that it can be difficult to follow this framework for all students. This was especially true in mathematics, a subject that builds on requisite knowledge, where we observed teachers re-teaching concepts from previous grade levels. Most educators agreed that science was easier to teach students because the lessons were more free-standing and required less requisite knowledge than mathematics. One educator we interviewed expressed, in paraphrase, “*It is unfortunate that students can only stay back one year before they are forced to move to the next grade level even if they are not prepared to do so*” (Teacher 3, personal communication, September 5, 2018).

Teachers attempted to vary their STEM lesson teaching methods in order to help students learn, but were often limited by materials. Teachers indicated in their interviews that it was hardest to use kinesthetic methods due to the lack of funding for lab materials. Teacher 5 mentioned, paraphrased, “*It is easier to find items to incorporate into science lessons, but math related objects*



such as protractors, calculators, or rulers are not easy to substitute” (Teacher 5, personal communication, September 5, 2018). In a majority of classrooms, educators found a way to use all three teaching methods despite these limitations.

We observed that Namibian students studying in schools with limited resources such as Namutuni have a greater chance of falling behind in their education. If students are not equipped at the primary level, they cannot be expected to succeed at the secondary level. This likely leads to a lower chance of involvement in STEM higher education. While many of the inhibiting factors we discussed in our background can be seen at the Namutuni School, these factors were less prevalent at the Amazing Kids Academy.

### Resources, Curriculum, and Teaching Methods at the Amazing Kids Private School and Academy

The Amazing Kids Private School and Academy had the required resources to enable educators, parents, and students to participate in quality STEM education. The private school receives funding from parents which affords an adequate budget towards classroom resources. In our research, we found that because private schools are subsidized by the government, the Amazing Kids Academy was given N\$2 million in 2016 to afford costs such as teacher salaries, student scholarships, and maintenance

(Nhongo, 2017). The effects of these generous government subsidies alongside the tuition were observed as each classroom had abundant materials such as Smart Boards, an interactive whiteboard tool, and reading materials. It was even noted by some educators in our interviews that they felt they had too many resources, which served as a distraction in some cases. We observed the school to have multiple science and computer labs that served as an asset to STEM education. During our visits, we observed that every child in the

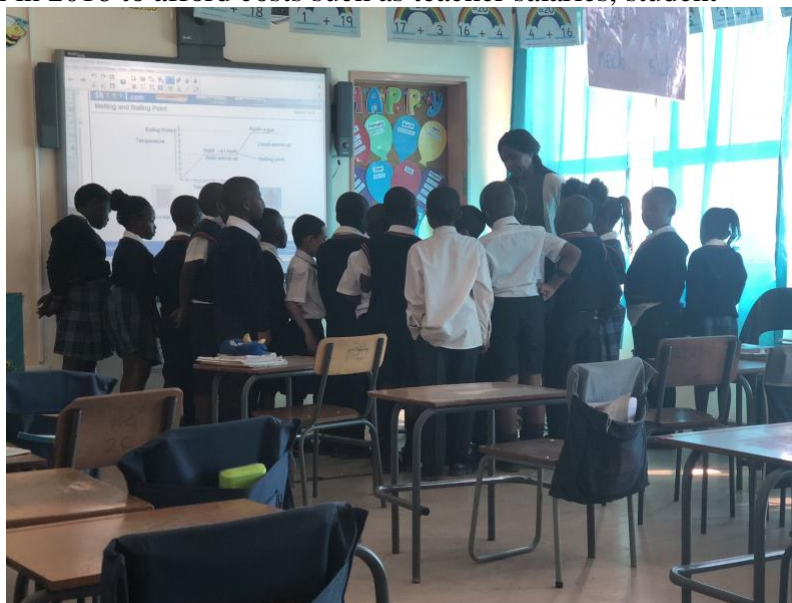


Figure 9: Amazing Kids Science Lesson Using Smartboard and a Physical Lab

school was equipped with either a laptop or tablet which Teacher 1 told us their parents provided. She told us, paraphrased, “The school has an active parent network who are willing to step in and provide any additional required materials that teachers request” (Teacher 1, personal communication, September 13, 2018).

The Namibian National Curriculum is also used at Amazing Kids Academy, but is taught at an accelerated rate. In a 4<sup>th</sup> grade class at Amazing Kids Academy, it would not be uncommon to see the class covering 5<sup>th</sup> grade material. Educators at the school indicated in their interviews that their students have high passing rates on national examinations. They attributed this to their advanced curriculum that is usually a year ahead of the National Curriculum. The resources and

support provided at Amazing Kids Private Academy enable students to not only have an adequate STEM education, but an accelerated one as well.

The resources at Amazing Kids Private Academy allow educators to cater teaching methods used in STEM lessons to promote positive educational results. Teachers' access to science and math materials ensured their lessons were unrestricted; kinesthetic lessons were common in our classroom observations. Multiple teachers mentioned that they needed to plan lessons carefully so that the resources used in different methods of teaching, such as the Smart Board, did not become a distraction from results based learning. Other teaching methods highlighted by teachers were group learning in the classroom and projects completed at home. The projects completed at home allowed educators to extend education outside of school hours for increased STEM exposure.

The positive opportunities and resources provided at schools such as this in Namibia improve the chance that students can succeed in secondary education, and later pursue higher education. The Amazing Kids Academy and the Namutuni Primary School are examples of how varying STEM resources, curriculum, and teaching methods can positively or negatively impact student success. In addition to opportunities, the way students react to their educational circumstances can have a lasting impact on their future education.

### Objective 3: The Current Student Experience

In order to identify areas for improvement within the current student STEM experience at the primary level, we again leveraged classroom observation. Our observations were conducted at the Namutuni School and the Amazing Kids Academy. Due to the research limitation of observing one public school and one private school, our observations cannot generalize the experience of all students in Namibia. Overall, we observed that teacher enthusiasm affected student engagement, and that students at both schools were performing better in science subjects compared to math subjects.

#### Student Engagement

While most classes appeared to have a high level of engagement at both schools, students in junior primary classrooms showed more engagement than the students at the senior primary level. Students at the junior primary level were far more involved in their lessons, and were much more willing to ask and answer questions. While the students at the senior primary level still showed engagement, they were less responsive to questions and had less desire to interact in classroom discussions. Teacher 2 at Amazing Kids Academy believed that as her students got older, they lost interest in school due to pressure from friends. Despite distractions at Amazing Kids Academy, we saw that students were more engaged in their lessons than the students at Namutuni as we observed a larger percentage of students at Amazing Kids Academy raised their hands to answer questions.



*Figure 10: Students at Namutuni Primary School Raising Their Hands to Answer a Question*

Teacher enthusiasm had a great impact on student engagement at both schools. When a teacher showed a higher level of enthusiasm in the classroom, the students became more engaged in the lesson. We noted that junior primary level teachers tended to be more enthusiastic when teaching than the senior primary teachers, which produced a higher level of student engagement. Additionally, the teachers at Amazing Kids Academy showed more enthusiasm overall in their classes, which also attributed to higher student engagement than at Namutuni.

### **Student Understanding**

The students at Namutuni Primary School seemed to be attempting to understand the lessons, but were not yet well versed in the material. We observed this when a teacher would call on a student in class, they would not consistently respond correctly. In comparison, the students at Amazing Kids Academy seemed to have a better understanding of their lessons. In an observed Grade 3 classroom, students completed an activity in front of the class where they colored in pieces of a shape to represent fractions. At each student's turn, they were able to correctly complete the activity. At the Namutuni School, we observed a Grade 5 classroom completing an activity where students had to convert different units of measurement. The students worked in groups and reported their answers in front of the class. All groups answered incorrectly, causing the teacher to spend more time working on the topic.

### **Student Performance**

Student performance was better at the Amazing Kids Academy than at the Namutuni School, however, students generally performed better in science than math at both schools. At Namutuni, teachers of both the junior and senior primary level stated that the students were performing below their expectations in mathematics. In comparison, they said that the students met their expectations at both the junior and senior primary levels in science subjects.

At Amazing Kids Academy, we found that students were performing well at the junior primary level, while they were underperforming at the senior primary level. The teachers had many hypotheses as to why this was occurring. Teacher 2 believed that the students were losing their love for school as they got older. Another response that we heard from a few teachers at both schools was that the students were not receiving the proper educational foundation to succeed at higher levels of education. If a student did not learn the basic concepts, they could not move on to more complex knowledge. This limiting factor causes students to fall behind in later grades, and causes the students to underperform.

### **Student-Parent Interaction**

Parent involvement has a large impact on the student experience. The students at Namutuni rely on their parents for a great deal of educational support. Parents must buy students all their school supplies, and are often relied on for homework and study help. If a parent is unable or unwilling to provide this, their child is immediately put at an educational disadvantage. At Namutuni, we saw a few cases where parents were hindering their child's education, whether it be from a lack of resources or refusal to help teach at home. In one case, Teacher 3 left notes in her students' homework books asking for parents to help their children with homework. She mentioned that she has done this in the past with varying success. While there are parents that help their

children excel at Namutuni, the student experience is often hindered due to the lack of parent involvement at home.

In contrast, the involvement of parents at the Amazing Kids Academy had a positive impact on the student experience. At Amazing Kids Academy, they frequently hold parent meetings to inform them about the happenings of the school, and how the parents can continue to support their children's education. Teachers leverage a group messaging platform to communicate with their students' parents. The group is used to request parents to bring in replacements for missing educational supplies. Students at the Amazing Kids Academy are less distracted from their education because their parents play a positive role in supporting them.

## Objective 4: The Current Teacher Experience

In order to identify the areas for improvement within the teacher experience at the primary level we conducted observations at the Namutuni School and the Amazing Kids Academy. Overall we saw that teachers at the Namutuni School are frustrated with the tools they are given to teach their lessons, and it is affecting the students. At the Amazing Kids Academy, the teachers were given everything they need to succeed in the delivering of their lessons, however, they still faced other frustrations.

### Teachers' Experiences at the Namutuni Primary School

Teachers at the Namutuni Primary School felt prepared to teach, while some recognized the importance of continuous learning through in-service training. Four of the teachers believed that in regards to subject matter knowledge, they felt prepared and did not require further training. Teacher 4 regarded, paraphrased, "*I am an advocate of lifelong learning. There is always room to improve.*" By introducing the teachers to more subject matter knowledge, they could potentially learn something they did not realize would be useful to know in teaching their students. One point that was brought up by every teacher at the Namutuni School, was that they did not feel they had the adequate resources to teach their lessons. A lack of resources limits the number of teaching methods they can use. Further, students have different preferred learning styles, and a lack of variety in teaching methods can affect their performance on assessments. From our observations, however, we saw that the teachers were being creative with the resources they had available to them and were still able to use audio, visual, and kinesthetic methods in a majority of the classes.

When it came to flexibility in their lesson plans, all of the teachers followed the National Curriculum for math and science. Teacher 5 mentioned that it was difficult for them to teach the entire curriculum, as all of the topics listed must be covered by the end of the school year. If they want to do any supplemental activities, or cover any subjects that are not in the curriculum, they have to plan well in advance. Despite the limited time, teachers value supplemental activities, as they believe the topics they introduce are beneficial to the learner. The challenges or frustrations which teachers encountered varied by grade level. At the junior primary level there were three main challenges: *the parent's involvement, connection to the students, and the student-to-teacher ratio.* Teachers found it frustrating when parents were disengaged from their children's education. Teacher 4 mentioned the importance of the "*3-part plan*"; in order for the student to excel in the classroom, it was necessary for the learner, the teacher, and the parents to all work together. Teacher 5 mentioned that they found it more difficult to teach students who came from a different



tribe then he came from. He attributed this not only to the language difference, but to a connection and understanding that students had if they were from the same tribe as him, that other students lacked. A final frustration at the junior primary level was the number of students each teacher was responsible for. We observed the largest class in the school with a student to teacher ratio of 44:1, which was similar to the size of the other classes we observed. With only one teacher and 40-minute class periods, the teacher cannot spend even 1 minute with each student every class period. This affected the amount of information that could be presented to the students. In one classroom, we



*Figure 11: Image Showing a Crowded Classroom at the Namutuni Primary School*

observed that when the students did a 5 question math assessment, it took the remainder of the class period for the teacher to be able to grade the assessment.

Teachers at the senior primary level expressed their frustration with the abilities of their students. Teachers 3, 5, and 6 noted that the students in their classes lacked the foundation needed for them to be able to teach more advanced concepts. The teachers became frustrated when students were struggling to understand a subject, but there was not enough class time to repeatedly go over it. In some cases, this could have caused the whole class to fall behind, and by the end of the year the teacher struggled to fit the entire curriculum in.

When looking at the qualification of the teachers at the Namutuni School, all of them were certified to teach the level they were teaching. Of the 5 teachers we observed, 3 of them received their certification from UNAM. From our observations and interviews, we can see that the teachers have the knowledge and motivation to teach; however, the teacher experience at Namutuni had many areas for pedagogical improvement.

### **Teachers' Experiences at the Amazing Kids Private School and Academy**

We wanted to better understand and compare the teacher experiences and resources available at the Namutuni School relative to the Amazing Kids Academy. When the teachers at the Amazing Kids Academy were asked if they felt prepared to teach their lesson plans, all of them said they felt prepared to teach. All of the teachers prepared for their lessons ahead of time and utilized either the internet or Smart Lessons to assist with their lesson plans. This attests to the school's availability of resources which enhances the teacher experience.

When asked whether or not they had adequate resources to teach the lessons, the teachers said they have many resources available to them. The abundance of materials mitigated the difficulties teachers faced in collecting resources to incorporate into their lesson plans. Teacher 7, however, felt overwhelmed with options. When preparing to teach their lessons, this made the

process harder as they had to balance out their lesson plans between competing technologies such as the Smart Board, laptops, and physical lab materials.

Teachers at the Amazing Kids Academy believe they have a good balance between structure and freedom in their lesson plans. Teacher 2 mentioned how she could teach any subject freely, as long as all the material in the curriculum was covered by the end of the year. Additionally, teachers talked about their ability to teach to the level of individual students, which is made possible by the class size of around 20 students. If there were a few students falling behind, it was easy to keep them after school to give them additional help. Similarly, it was possible to provide additional resources to a student who was ahead of the class, or to suggest that the student move ahead to an appropriate grade level.

Teachers at the Amazing Kids Academy faced a variety of frustrations, however, they differed from those at the Namutuni School. Teachers 7 and 8 mentioned that discipline was difficult at the school. Teacher 8 stated that the learners were becoming immune to her usual technique of keeping them in at break. She said the kids no longer responded to the punishment. Teacher 1, mentioned they were challenged with keeping the students' attention in class. One final frustration was with the Namibian education system. Teacher 7 believes that students should be placed in the grade they belong in, and just because they pass one test does not mean they fully understood the content. Teacher 1 had been an educator in the Zimbabwe public school system, and when asked what challenges she faced in her profession, she said that teaching at Amazing Kids Academy was "*like being on holiday*", which shows the contrast between our two case study schools.

Teachers at Amazing Kids Academy were all qualified to teach the grade level they were teaching. One interesting fact to note was that none of the teachers we interviewed at Amazing Kids Academy were trained in Namibia to teach; 1 was from South Africa and 3 were from Zimbabwe. This could reflect that the private school had more money to hire the best educators they could find. From our interviews, we could see the teachers were very motivated and had adequate resources, but there is still more they can learn to pass onto their students.



Figure 12: Image Showing Space Available in Amazing Kids Academy Classroom

## CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

This chapter presents our conclusions based on our findings and our recommendations which are made with the intention of supporting NUST, UNESCO, and NMoE in furthering their mission to improve STEM education in Namibia. Our stakeholders hypothesized that primary education is the logical starting point to increase STEM involvement in Namibia, and this was supported by our findings. Challenges to student success surfaced at the primary level, however, our NUST student interviews confirmed that if those challenges are not addressed, they will continue through to the secondary level. Our findings also point to the necessity of incorporating engaging labs which utilize accessible and relevant materials into our Kopano lessons, and to provide suggestions to schools in ways they can further expose their students to STEM and strengthen their educational foundations.

Our NUST student surveys informed us of the different perspectives university students had regarding their STEM experiences. We were able to gather NUST student demographic information, however, the statistical significance of our results was limited in regards to the size of our sample. For example, gender-based exclusion in STEM education is something which exists worldwide, yet our limited demographic data does not point to this being a factor in Namibia (Beede et al., 2011). NUST students did not bring gender disparities to our attention. If we had set out to understand how the different genders interact within STEM education in Namibia, gender-based exclusion may have surfaced in our findings. While we could not conclude anything about gender demographics, regional demographics seemed to play a role in our findings. One Land Administration student from Luderitz stood out to us, as his area of study correlated with the most prominent industry in his region, the mining industry. We believe this points to the fact that students are influenced by the regions in which they grew up, however, we only received a few accounts of similar instances in our student surveys.

While our student surveys could not inform us on the statistical significance of certain demographics, we were able to identify factors that drew students towards or away from pursuing STEM higher education. Both groups of students commented on the effectiveness of opportunities outside of the classroom such as career fairs, after-school classes, and extra-curricular activities. STEM majors exposed to these opportunities commented that they had a positive impact on their career path, while non-STEM majors acknowledged a desire to have had those opportunities. Non-STEM students frequently attributed their motivations to the current or potential economic success of the industry they would enter. This coincided with the industries we found to be most prominent in Namibia, as none of them were STEM related (Namibia Statistics Agency, 2017). These industries may be setting an example for students in regards to what career paths are the most realistic to pursue. Because STEM students did not comment on the economic success of STEM industries as an external factor, we are led to believe that students perceive the STEM job market to be limited.

Although factors outside of education influenced students in choosing their major, educational experiences also played a role. While talking to NUST students about their past educational experiences, we received an array of positive and negative responses regarding secondary education. Students commented on either being pushed towards or away from STEM by ineffective or unmotivated teachers. This supported a hypothesis we formed in Objective 4 of our Methodology Chapter. Due to the nature of our open-ended questions, not all students specified whether secondary education had any effect on their pursuit of STEM. We received enough

responses from students, however, that indicated to us that secondary education plays an influential role in a student's choice of major. In order to test our stakeholders' hypothesis, we chose to keep our focus on the primary level.

Of those who mentioned primary level education in our student surveys, some non-STEM majors regarded that they lacked a foundation in either science or math and this caused them to lose interest in the subjects. This weak foundation coincided with the responses we received from teachers at the primary level. Students at both the Namutuni Primary School and the Amazing Kids Academy were generally performing below their teacher's expectations in math. Teachers attributed this to a weak foundation from previous grade levels. Further, teachers expressed their frustrations with limited classroom time which resulted in an inability to review topics at length. Both NUST students and primary school teachers confirmed that science was also a challenging subject for students to understand. This could be attributed to the fact that students were not being introduced to Chemistry and Physics, or Physical Sciences, until Grade 8 (National Institute, 2016b). The Namibian curriculum focuses on Natural Sciences (Environmental Sciences, Biology, and Health Sciences) as NMoE believes it is important to emphasize Health Sciences (National Institute, 2016b). Students may feel less prepared when they are introduced to Physical Sciences at the secondary level, further contributing to a weak foundation in science topics. In addition to our findings regarding the curriculum, we also identified that the teaching methods used by STEM educators varied.

In our Methodology Chapter, we speculated that we would be able to find a correlation between the number of teaching methods used and student success. While most teachers used three teaching methods (auditory, visual, and kinesthetic) at both the Namutuni School and the Amazing Kids Academy, we were not able to observe enough classrooms to make a definitive claim on how this affected student performance. Further, we were not qualified to assess the quality or effectiveness of teaching methods due to our limited pedagogical knowledge. Regardless of the effectiveness of teachers, we found student success also depends on at-home parent involvement.

Teachers at both schools indicated that the degree of parent involvement could either promote or inhibit student and teacher success. At the Amazing Kids Academy, parents were extremely involved in supporting their children's education through at-home help and review of materials, which positively impacted the students. At the Namutuni Primary School, students were inhibited by the lack of parent involvement. Teachers at the Namutuni School found this to be a challenge, and actively urged parents to increase their at-home involvement. We did not foresee parent involvement playing such an influential role, and because of this we did not have the opportunity to organize a parent-teacher meeting to gather insight. While we did not have the time to further investigate the role of parents in STEM education, we were able to examine the effects of a factor we anticipated to be an issue: limited resources.

A lack of funding and resources negatively impacted STEM labs and classroom activities at the Namutuni Primary School. A NIED report stated that a lack of funding limited public schools' abilities to buy lab resources and materials (National Institute, 2016b). We found this to be true at Namutuni, where the school was not able to provide appropriate lab equipment to the students, let alone pencils, rulers, and notebooks. Due to this, teachers at Namutuni conducted labs using minimal resources which limited the quality of STEM exposure. Not only were STEM labs impacted by limited funding, but students were distracted by the act of sharing pencils and other resources with each other during normal classroom activities. Meanwhile, the Amazing Kids Academy was equipped with an abundance of resources which allowed them to focus on educating



the students and exposing them to STEM topics in exciting ways. Not only do they receive tuition from each student, but they are afforded government subsidies to cover teacher salaries, student scholarships, and building maintenance (Mutorwa, 2002).

In comparing public and private schools, we were limited in that we only had two case studies. Further, our findings only reflect two schools in Windhoek, Namibia. Our research, conducted in an urban area, showed us that students with higher SES had more access to the benefits of a private education, and therefore, were at an advantage compared to those with lower SES. If we had observed classrooms and interviewed teachers in rural areas, our findings would be more comprehensive in this regard. This is because a majority of the population lives in the northern rural regions of Namibia (Central Intelligence Agency, 2018); more learners reside outside of the urban areas and are faced with different educational problems. The goal of our observations and interviews was to inform the creation of our Kopano lessons, and while we were able to do this, more data would be useful to obtain statistically significant information on what needs to be improved in the STEM classrooms at the primary level.

## Recommendations

We recommend increasing student exposure to STEM outside of the classroom to spark student interest and help them develop a passion for STEM subjects. These events can also show students the practicalities and relevance of STEM careers in Namibia. External events would require faculty and staff to devote extra time to organizing them, so schools would have to find willing faculty to participate. Although creating STEM exposure activities, such as career fairs, guest speaker events, and extracurriculars may be costly and time-intensive, schools may be able to mitigate these costs by collaborating with one another to create successful events.

### ***2. Promote collaboration between public and private schools in Namibia.***

A cluster system exists in Namibia which allows schools to collaborate and share ideas and resources (Dittmar, Mendelsohn, & Ward, 2002). We recommend that NMoE leverage the current cluster system to promote private and public school collaboration in regards to STEM exposure. Currently, private schools must ensure that 10% of their students come from disadvantaged communities and the schools must provide them with full-tuition scholarships (Mutorwa, 2002). Although the private school system attempts to justify its government subsidies by helping those in disadvantaged areas, this could be an opportunity for them to show that their resources are being leveraged to better STEM education in Namibia. Private schools, such as the Amazing Kids Academy, could host STEM workshops and activities open to public school students, and teachers could come together to discuss their different teaching methods and experiences. Collaboration would increase the number of resources available to public schools and the overall STEM exposure of students.

### ***3. Solidify the curriculum and foundation of STEM concepts.***

We recommend that the NMoE curriculum be revised to introduce Physical Science concepts earlier than Grade 8, because it may help students strengthen their science foundation. Exposing students to more science topics would help prepare students for the material they'll encounter at the secondary level. We also recommend that in order to strengthen students' math skills, teachers encourage students to use summer break or after-school work to reinforce concepts

at home. Doing so will help solidify the students' foundations in math subjects as they advance in their education.

#### **4. Leverage Kopano to promote labs which incorporate attainable resources.**

Kopano lessons provide labs to teachers that do not require an abundance of expensive materials. Most of the materials incorporated in these labs are relevant and familiar to students, which also mitigates the intimidation which conventional lab materials may introduce. Further, we included alternative lab ideas which would allow teachers to introduce concepts with even less resources, which Ms. Eva Asheela from NIED had mentioned was a goal for this project (personal communication, September 5, 2018). Promoting exposure of STEM through interactive labs also allows students to gain a deeper understanding through kinesthetic learning. We strongly recommend that NUST, UNESCO, and NMoE continue to leverage Kopano in order to promote relevant STEM education development.

## Future Research

After completing our research, we identified a few areas for further investigation. Our suggested research areas are as follows:

- 1. Explore the current STEM education climate in additional primary schools.**
- 2. Investigate STEM education at the secondary level.**
- 3. Research the teaching methods at the primary level for STEM subjects.**
- 4. Research the effects of Namibian parent involvement in their children's education.**
- 5. Survey a larger sample of university students in Namibia regarding what motivated them to choose their major.**

We sought to assist NUST in identifying the factors influencing student interest in STEM higher education in Namibia. We found that education at the primary level is the foundation for exposure to STEM, and improvement at this level can spark student interest that continues into higher levels of education. In order to continue the growth of STEM education and industry in Namibia, other areas outside of primary education must be addressed. Our research has identified many areas of further study which can be addressed through future initiatives by our stakeholders. If our recommendations are taken into consideration, the STEM education climate in Namibia could be further improved.

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# APPENDIX A: TIMELINE

Week 1 8/20	Monday	Tuesday	Wednesday	Thursday	Friday
	Setting up Meetings and Research Times				
Week 2 8/27	Monday	Tuesday	Wednesday	Thursday	Friday
	Student Interviews				
Week 3 9/3	Monday	Tuesday	Wednesday	Thursday	Friday
	Data Analysis/ Interviews and Observations with Primary Schools				
Week 4 9/10	Monday	Tuesday	Wednesday	Thursday	Friday
	Data Analysis/ Work on Deliverable				
Week 5 9/17	Monday	Tuesday	Wednesday	Thursday	Friday
	Work on Deliverable				
Week 6 9/24	Monday	Tuesday	Wednesday	Thursday	Friday
	Work on Paper				
Week 7 10/1	Monday	Tuesday	Wednesday	Thursday	Friday
	Work on Paper/ Presentation				
Week 8 10/8	Monday	Tuesday	Wednesday	Thursday	Friday
	Work on Paper/ Presentation and Teacher Workshop				



# APPENDIX B: NUST STUDENT SAMPLE INTERVIEW QUESTIONS

## Participant Notice:

We are a group of students from Worcester Polytechnic Institute in Massachusetts, USA who are working with NUST's Teaching and Learning Unit to carry out research. We are conducting interviews to learn about what has influenced university students in Namibia to select their specialization. We strongly believe this kind of research will ultimately enhance the participation of students in STEM fields at the Namibia University of Science and Technology. Your participation in this interview is completely voluntary and you may withdraw your participation at any time. Please remember that your answers will remain anonymous and will only be used in an aggregated way. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. This is a collaborative project between NUST, the Namibia Ministry of Education, UNESCO, and WPI, and your participation is greatly appreciated. If interested, a copy of our results will be provided to NUST's TLU at the conclusion of the study.

1. Did any of your parents attend higher education?
2. What are your parents' types of employment?
3. What past educational experiences have led you to choose your specialized area of study?
4. What external factors have influenced your choice of education specialization?
1. Are you satisfied with the educational opportunities you have been given? Why or why not?
2. What career or job opportunities would you like to pursue after you finish your studies at NUST?

# APPENDIX C: NUST STUDENT SURVEY

## Participant Notice:

We are a group of students from Worcester Polytechnic Institute in Massachusetts, USA who are working with NUST's Teaching and Learning Unit to carry out research. We are conducting interviews to learn about what has influenced university students in Namibia to select their specialization. We strongly believe this kind of research will ultimately enhance the participation of students in STEM fields at the Namibia University of Science and Technology. Your participation in this interview is completely voluntary and you may withdraw your participation at any time. Please remember that your answers will remain anonymous and will only be used in an aggregated way. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. This is a collaborative project between NUST, the Namibia Ministry of Education, UNESCO, and WPI, and your participation is greatly appreciated. If interested, a copy of our results will be provided to NUST's TLU at the conclusion of the study.

**Gender:** \_\_\_\_\_

**Please select one:**

- Part-time student
- Full-time student
- Distance student

**What is your specialization?**

**Where did you grow up?**

**What is your mother tongue?**

**What other languages do you speak?**

**Primary School**

**School Name:** \_\_\_\_\_

**City:** \_\_\_\_\_

**Please select one:**

- Public
- Private

**Secondary School**

**School Name:** \_\_\_\_\_

**City:** \_\_\_\_\_

**Please select one:**

- Public
- Private

# APPENDIX D: SCIENCE TEACHER INTERVIEW QUESTIONS

## Participant Notice:

We are a group of students from Worcester Polytechnic Institute in Massachusetts, USA who are working with NUST's Teaching and Learning Unit to carry out research. We are conducting an interviews to learn about of what has influenced university students in Namibia to select their specialization. We strongly believe this kind of research will ultimately enhance the participation of students in STEM fields at the Namibia University of Science and Technology. Your participation in this interview is completely voluntary and you may withdraw your participation at any time. Please remember that your answers will remain anonymous and will only be used in an aggregated way. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. This is a collaborative project between the NUST, the Namibia Ministry of Education, UNESCO, and WPI, and your participation is greatly appreciated. If interested, a copy of our results will be provided to NUST's TLU at the conclusion of the study.

1. What labs/physical materials are available for your and your students' use in the classroom?
2. What subjects of science and math are included in the curriculum?
3. Are different methods being used to teach the different subjects of science and math? Why or why not?
4. How are the students performing on their science and math assessments?
5. Why do you think the students' assessments have produced such results?
6. Do you feel prepared for your science or math lesson plans? Why or why not?
7. Do you feel as though you have adequate resources to teach the science or math lessons? Why or why not?
8. Do you believe that you have a good balance between structure and freedom in your lesson plans? Why or why not?
9. What frustrations or challenges have you encountered in your teaching career in Namibia?
10. What training did you receive to become a teacher?
11. What motivated you to become a teacher?

# APPENDIX E: OBSERVATIONS RUBRIC

Primary Level Teaching Methods						
Class #	Number of Students	Subject				
Rubric	1	2	3	4	5	Notes
1) <i>What amount of materials are available in the classroom for labs?</i>	No lab materials available	Limited amount of lab materials	Adequate amount of lab materials	Abundant amount of lab materials	Excess amount of lab materials	
2) <i>What kind of materials are available in classroom for labs?</i>	No lab materials available	Slight relevance of lab materials	Appropriate lab materials	Abundant lab materials	Excess lab materials	
3) <i>Methods of Teaching</i>	No teaching method is used, lesson is incoherent	One method of teaching was used	Two methods of teaching are being used	Three teaching methods are used	Teacher uses all three methods equally	(audio, visual, kinesthetic)
4) <i>Teacher Enthusiasm</i>	Teacher does not want to be there	Teacher seems to be lacking enthusiasm	Teacher does not seem unenthusused or overly enthusiastic, neutral	Teacher is engaging the students in a heightened way	Teacher is excited about the subject and passes the excitement onto the students	
5) <i>Student Attention Level</i>	Majority of students are completely distracted or not responding	Some students are distracted or not responding	Students are not distracted, but not necessarily extremely responsive	Some students are responding, all students are engaged	Most students are responding, all students are engaged	
6) <i>Student Understanding</i>	Student has no new understanding of the lesson	Student has a poor understanding of the lesson	Student is attempting to understand the lesson	Student has a good understanding of the lesson	Student has a complete understanding of the lesson	

# APPENDIX F: AMAZING KIDS PRIVATE SCHOOL AND ACADEMY PHOTOGRAPHIC CONSENT



Emma Kakona <ekakona@amazingkids.edu.na>

Today, 2:54 AM

Tillotson, Christopher Michael; gr-namibiatlu



Reply all | v

Dear Tillotson, all fine thanks! Full permission granted and our parents are included.

"The management and parents of Amazing Kids Private School and Academy grant the Worcester Polytechnic Institute (WPI) students permission to use the graphics/photos of our school, staff and learners."

God bless!

Emma Kakona



**Amazing Kids Private School & Academy**

Tel: +264 61 304 974

||

Fax: +264 61 304 975

||

Email:

[ekakona@amazingkids.edu.na](mailto:ekakona@amazingkids.edu.na)

Train a child the way he should go and when he is old he will not turn from it.

Proverbs 22:6

# APPENDIX G: NAMUTUNI PRIMARY SCHOOL PHOTOGRAPHIC CONSENT

**From:** ASINO JOHANNA ELINA NDAPANDA <asinoj90@gmail.com>

**Sent:** Monday, October 8, 2018 2:58 PM

**To:** Nkusi, Maurice (TLU) <mnkusi@nust.na>

**Subject:** Re: Re:Permission to Use Pictures

Good afternoon

We at Namutuni Primary school gives permission to the Worster Polytechnic Institute (WPI) students who took some pictures during the visit at our School to be able to use the pictures in their report.

They got the permission from the school administration and parents to take pictures of the learners in class.

Thank you for making us part of the project project.

Kind regards,  
Mrs J E N Asino  
School Principal

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