

```
edge in the osmdb
, parent_id, node1, node2, distance, geom_type) in enumerate( osmdb.edges() )

find rise/fall of edge, if profile
rise=0
fall=0
if profiledb:
    profile = profiledb.get(profile)
    if profile:
        rise, fall = profile

# insert end vertex
vertices.setdefault(
vertices.setdefault(
# create 10
str

if

static char *kwlist = {"seed", NULL};
if (!PyArg_ParseTupleAndKeywords("s#|i", kwlist,
&target_str, &target_str_len, &seed)) {
    return NULL;
}
murHash3_x86_32(target_str, target_str_len, seed, result);
PyLong_FromLong(result[0]);
FromLong(result[0]);
```

SOUTH AFRICAN Developer REPORT // 2017



Hyperion Development has compiled this report to highlight the South African educational routes into a developer career, as well as compare these qualifications to allow potential students to make informed decisions about their future.

South Africa's tech industry is **has seen rapid expansion in the past two decades**, and contributed R94 715 million to the economy in 2012 - 2.9% of the country's total GDP. The 2015 Global Connectivity Index has South Africa poised as one of the top three developing countries with the most potential **to use Information Communications Technology (ICT) to boost their economic growth**.

As South Africa's tech industry continues to grow, the role of a developer will evolve alongside it. This report highlights the need for developers in South Africa, and details how one can empower themselves to become a valuable player in the world of technology.

www.hyperiondev.com

Why become a developer?

Software Development: A Uniquely Appealing Career

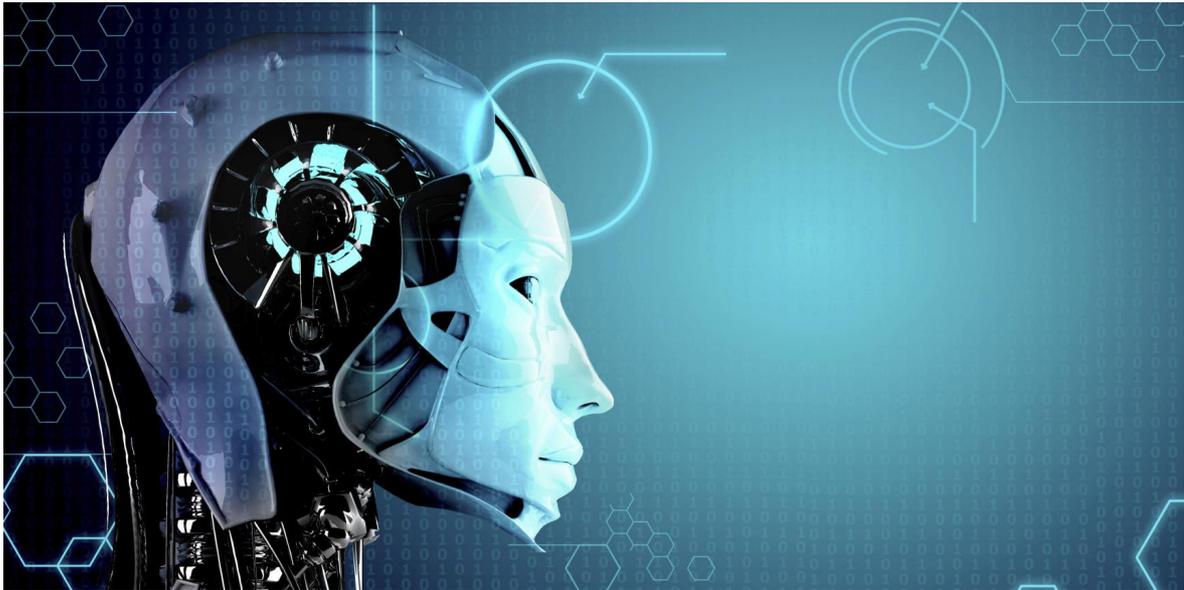
Millennials will make up 50% of the global workforce by 2020, and they are the largest and most diverse group of people to step into the shoes of the generations that came before them. This is a generation, loosely described as being born between 1980 and 2000, that is defined by their use of and understanding of technology, and it is the generation that has already proven they are powerful workers who are changing the way they work, where, and how they function in the workplace. They have shaped the future's work culture to include more open-minded practices, such as flexible hours, remote-working, and a "quality over quantity" mindset. A typical millennial is the ideal developer - they possess the desire to keep learning, focus and flexibility, technical know-how, and the aptitude to solve problems in a timely, efficient manner.



Companies like Google and Apple have been markedly successful in retaining millennial talent, as their flexible workplace culture and symbiosis with technology naturally appeal to younger employees. Globally, companies are recognising these successes, and slowly but surely moving away from the rigid corporate structures and strict career paths of previous years. This recognition of employees' needs means tech companies are more likely to be creative and innovative in their approach to work, compared to industries like law or medicine which are still quite traditionally-minded. Collaboration and company-wide synergy are hugely important functions in the tech industry, which breed workforces that perform smarter, quicker, and more effectively.

Why become a **developer?**

Developers are no longer just lone-working cogs in the machine - they are meaningful parts of a whole force working towards one unified goal.



One major element of being a developer in the next ten or twenty years is that it is a fairly future-proof career in a world that is becoming increasingly automated. As computers and software rapidly advance they can and will replace many current jobs in society - research estimates 47% of total employment in the USA is at high risk of being automated in the future. However, the programs that run them will always need to be developed and maintained, which will only add to the growing demand for developers. While millennials get a lot of praise (and scorn) for being comfortable with technology, the hard truth is that the generation as a whole face the threat of automation much more than previous generations did. Today, better and more efficient Artificial Intelligence (AI) systems are slowly eliminating positions that Generation X and the Baby Boomers once had - this means millennials are handed the task of making the human element of work valuable, meaningful, and long-lasting. Talented developers are doing just that by adjusting their skills and mindsets to this new and flexible workforce paradigm.

Why become a **developer?**

Developers are already unique players in the current global labour force. Their power lies in their ability to learn skills which plug the skills gap, and these skills are their protection against the threat of automation. Developers as individuals possess the potential to increase their value the more they learn, with many starting on the career ladder in a place that matches their skills and experience, and climbing into new positions fairly quickly despite being in a younger age group. This gives them the ability to command higher salaries the more worth they are able to produce through their work, and tech companies know this. Never before has a generation switched jobs so much, with research indicating millennials are the most willing to look for and accept new roles despite their current one. This isn't due to a lack of loyalty, but more a lack of job engagement and meaning, which is a huge underlying issue for many who say they are actively seeking new opportunities while they are still employed.

In order to counteract this generational job-hopping, tech companies are leading the way in making roles more interesting and meaningful, with IT industry firms regularly featured on Best Companies to Work For lists online. These lists are usually compiled taking into consideration not only monetary reward, but also job engagement, task variety, professional development and an attractive work-life balance - all of which are just as important to the millennial generation. Furthermore, it is common practice for companies to enlist recruiters to headhunt the very best developers in their field, which means developers are competed for more than other kinds of jobs. This is especially true if they focus on an in-demand skill such as Java programming, which is predicted to continue dominating the field for years to come. Becoming a specialist allows developers to hone in on areas they enjoy and excel at, and offers the opportunity to grow into a leader in their field.



A simpler analysis of why the role of a developer may be a popular career path is that individuals feel they match up well with the common characteristics of a developer. For instance, patient people who are keen to persevere in the face of failure may have an easier time programming than impatient people who want immediate results. Optimism is key too, as developers may go through many hurdles until they find a solution or make a breakthrough in their work. This is where problem-solving skills are useful, as well as the ability to think in a linear and logical manner. Being resourceful, methodical, analytical, and adaptable are also valuable traits, and attention to detail is crucial to making a program run effectively. And even though many developers work remotely or on a freelance basis, it is still desirable to be a good communicator, as colleagues will often need to collaborate for the sake of efficiency and teamwork. All these attributes cross over one another to paint a picture of a well-rounded, intelligent worker who typically adds a great deal of merit to their company, which is possibly why the role of developer is sought after so much by individuals and employers alike.

The South African **developer shortage**

While South Africa is busy becoming a global economy, driven developers are being spread thin in a growing market. Despite one in four South Africans being unemployed, the current tech industry still struggles with a skills shortage. One way this is being rectified is through South African coder training initiatives such as Hyperion Development, which brings coding to low-income earners outside major cities, as well as providing cushioning for competitive developers to

enhance their skillsets. The Cape Town-based Cape Innovation and Technology Initiative (CiTi) uses e-learning and placement support to train unemployed young people through [their CapaCiTi project](#). Nigeria and Kenya are other powerful African economies where similar start-ups have gathered traction, such as the Lagos-born [Andela](#) and [Moringa School](#) based in Nairobi.



However, South Africa still has a tough journey ahead building the link between skills development and job creation: this is where internships can be used as platforms for people who are new to the industry, and actual coding experience can become more valuable in the face of traditional qualifications. Initiatives like [Africa Code Week](#) and [#BornToCode](#) are making strides in bringing digital literacy to Africa, which ultimately encourages long-term immersion into the workforce. Another way to rectify the gap in the market is by learning what skills are in demand, and then empowering oneself through education. This is where online education has revolutionised the tech industry in countries like the USA and UK, where [self-taught developers are quickly absorbed into the workforce](#) right alongside their traditionally-educated

peers. A difficult task that prospective employees face in South Africa is the **disconnect between talented developers and great tech companies**. The South African job market still relies heavily on a secretive recruitment process which doesn't share enough information with applicants about their role. For instance, will the developer be working from a cramped office cubicle all day for minimum pay, or does the role barely include any programming at all? It will take years for South Africa to be as savvy as the likes of Silicon Valley or London, but **there are recruitment initiatives** that are trying to bridge the gap by making it easier to access job opportunities in the tech industry. South African company **OfferZen** launched specifically to address this problem for developers, and only takes on tech companies that explain what the role and salaries are like upfront. Other African companies like **Kuhustle** and **Duma** also connect developers with businesses, and the fashionability of recruiting developers in this way suggest a future shift away from the traditional method of applying blindly to many jobs and hoping for the best.

The most in-demand technology jobs

IT and Technology remains one of the top employment sectors for earning potential in South Africa, **which is a trend that is expected to continue** in the coming years. According to the 2015 Global Connectivity Index, **South Africa is among the top three developing countries** that have the most potential to use ICT to boost their economic growth, along with China and Chile.

In particular, computer programmers and app developers have seen a spike in global demand in 2017, while **the highest overall growth of 27%** goes to web developers. Searching for the broad term "Developer"

usually returns thousands of results on most major job sites, and in South Africa this is no different, albeit on a slightly smaller scale. When the search is narrowed down to specific specialisms like “Java developer” or “SQL developer”, potential applicants can begin to assess what employers are looking for when scouting for talent and match their skills to particular job requirements.

Looking at data from South Africa’s largest job site, [Careers24](#), we can analyse which roles are currently most in-demand. It is important to note that these statistics will change and further develop as time passes, but for now they are a good indicator of what will remain popular within the South African job market for at least the next few years.

Most in-demand developer jobs in South Africa

#1	C# Developer
#2	Java Developer
#3	PHP Developer
#4	Web Developer
#5	Software Developer
#6	.NET Developer
#7	Senior Java Developer
#8	Python Developer
#9	SQL Developer
#10	Senior Web Developer

There are some global trends which are replicated in South Africa, such as Java being a dominant language sought after by companies. Another factor to consider is the tech skills shortage that affects the South African job market, where the amount of IT positions far outweigh the number of skilled individuals to fill them. However, a positive impact of this is that salaries are being pushed up as employers attempt to attract great developers. The shortage also allows developers to have more control and input in their roles, especially as more millennials filter into a workforce previously dominated by the older generation. This means that the future of developers in South Africa is generally bright, with job roles expanding to meet individual needs rather than employers offering generic positions with fixed descriptions.

How much do developers earn?

The short version of things is that it pays to code. The long version is that developers' salaries vary greatly according to specialisation, location, company, experience and even the developer's own personality. In general, developers' salaries are increasing as employers continue to recognise the importance of their work. As the need for tech skills continues to grow and the supply of tech talent remains lower than the demand, developers will carry on negotiating higher wages. The United States pays their developers an annual average of \$90,500 (about R1.2 million) which makes it the highest-paying country in the world - but it is important to remember that the US tech industry is years ahead of South Africa. This only means that as South Africa's tech industry prospers the salaries and benefits will increase as well.

However, current evidence suggests South Africa already pays developers with 5 or more years experience quite well in comparison to

other countries. The only issue with current evidence is that survey sample sizes are particularly small - only 473 South African developers responded to the 2016 [Stack Overflow Developer Survey Results](#), and none were included in 2017's version at all. But, overall, the results are still positive. Those 473 respondents concluded that a South African developer with 5 or more years experience commands an average annual salary of \$45,383 (about R600,000). After taxes and other deductions, a developer could be looking at a comfortable monthly pay cheque of R40,000, which is a hefty jump from [the average monthly gross wage](#) of R18,502.

Breaking down salary data into categories of developers and high demand locations can yield more accurate findings despite the small sample sizes. There is a clear trend that specialising in a certain skill increases salaries across the board, and that Cape Town and Johannesburg are the leading cities to find a developer job. Take a look at the table below for more information:

Job title	Median annual salary	Maximum annual salary	High demand locations	Individuals reporting
Senior Java Developer	R595,326	R1 million	Cape Town, Johannesburg	83
Senior Software Developer	R516,731	R811,774	Cape Town, Pretoria	254
Java Developer	R312,147	R636,842	Sandton, Johannesburg	296
Senior Web Developer	R304,953	R638,376	Cape Town, Johannesburg	33
.NET Developer	R283,753	R584,706	Pretoria, Johannesburg	159
SQL Developer	R280,543	R614,033	Cape Town, Johannesburg	106
Software Developer	R263,175	R533,895	Pretoria, Cape Town	1024
C Developer	R237,215	R541,563	Centurion, Johannesburg	177
PHP Developer	R237,089	R426,695	Cape Town, Johannesburg	114
Web Developer	R178,841	R384,882	Durban, Pretoria	317

It is clear that Cape Town and Johannesburg are the two major South African cities that have a high demand for a variety of developers. On average, the salary of an entry level developer in Cape Town is 38% higher than Johannesburg, specifically SQL and .NET developers. This could be due to a lower cost of living in Cape Town, or that Cape Town is considered the tech hub of South Africa. Intermediate developers with between 3 - 5 years' experience who specialise in Python and Delphi will earn more in Cape Town, while experienced developers who specialise in C++, Java, Linux and IIS will be paid more in Johannesburg. Senior developers - commonly those with more than 6 years' experience - are paid about 10% more in Johannesburg. The highest paying skills in this salary bracket are for Java and Javascript.

Comparing the two cities shows that a developer's' earning potential is higher in Johannesburg, especially the more senior that developer becomes, but Cape Town offers an appealing lifestyle along with unrivalled access to a prosperous tech industry.

What qualifications are needed to become a developer?

There are many routes into the tech industry which are only expanding as trainers become more savvy to the market's needs. The traditional route of studying Computer Science or Engineering at university is now competing with a range of other learning paths, such as short courses, diplomas, certifications, and the ever-expanding world of online education.

South Africa's education system operates under the National Qualifications Framework (NQF), which recognises and categorises qualifications into levels of achievement ranging from NQF Level 1

(Grade 9 of high school) all the way to NQF Level 10 (Post-doctoral research degree). Below are qualifications that fit into the NQF in South Africa.

Short courses

Part-time online courses, internationally recognised and good CV-boosters.

FOR DEVELOPERS

There are hundreds of short courses to help you become a developer, some of them specialising in a particular area such as Java or Software Engineering

WHERE TO STUDY

Damelin, UNISA, Hyperion Development, CTI Education Group, Mancosa, Intec College

DURATION

3 - 9 months

COST

R8,000 to R15,000 per course

Higher Certificate NQF Level 5

Skills-based, typically industry-orientated, and could help propel you into the world of technology.

FOR DEVELOPERS

Higher Certificate in IT or Systems Network Engineering

WHERE TO STUDY

Please see a list of all the public Technical Vocational Education and Training Colleges in South Africa [here](#). Note that not all of these colleges will offer an IT-related qualification.

DURATION

1 year

COST

About R20,000 for a full certificate

National Diploma NQF Level 5

These are good qualifications in South Africa, and while they are a lot like degrees, they are more career-centric and practical.

FOR DEVELOPERS

National Diploma in IT or Software Development

WHERE TO STUDY

Cape Peninsula University of Technology, Central University of Technology, Durban University of Technology, Mangosuthu University of Technology, Sol Plaatje University, Tshwane University of Technology, University of Mpumalanga, Vaal University of Technology

DURATION

Usually 2 or 3 years full-time

COST

About R30,000 a year

B. Tech NQF Level 7

WHY

A practical-focused qualification that is an alternative to Bachelor degrees in South Africa, with less of a focus on theoretical Computer Science or Engineering knowledge.

FOR DEVELOPERS

B.Tech IT B.Tech Software Development

WHERE CAN I STUDY IT

Cape Peninsula University of Technology, Central University of Technology, Durban University of Technology, Mangosuthu University of Technology, Sol Plaatje University, Tshwane University of Technology, University of Mpumalanga, Vaal University of Technology

DURATION

1-year top-up following completion of a National Diploma

COST

Tuition varies upon university, with annual fees between R30,000 and R50,000 or more.

Bachelor's Degree NQF Level 7

One of the more traditional route to becoming a developer is through studying a BSc, which aims to balance theoretical Computer Science with software development skills.

FOR DEVELOPERS

BSc Computer Science BSc IT

WHERE CAN I STUDY IT

Nelson Mandela Metropolitan University, North West University, Rhodes University, Stellenbosch University, University of Cape Town, University of Fort Hare, University of Johannesburg, University of Kwa-Zulu Natal, University of Pretoria, University of Witwatersrand, University of the Free State, University of the Western Cape, Walter Sisulu University

DURATION

3 years full-time, 4 - 5 years part-time

COST

Annual fees vary between R30,000 and R50,000 or more.

Honours Degree NQF Level 8

Specialises in one subject and is at least 25% research.

WHERE TO STUDY

Nelson Mandela Metropolitan University, North West University, Rhodes University, Stellenbosch University, University of Cape Town, University of Fort Hare, University of Johannesburg, University of Kwa-Zulu Natal, University of Pretoria, University of Witwatersrand, University of the Free State, University of the Western Cape, Walter Sisulu University

DURATION

1-year top-up following completion of a Bachelor's Degree

COST

Between R30,000 and R50,000

What are employers looking for?

Many job vacancies in South Africa have very similar Candidate Requirements when it comes to developer roles. The parts that differ substantially are to do with specific projects and areas of expertise, such as C# or application development. This means developer roles vary greatly depending on the company's nature and needs.

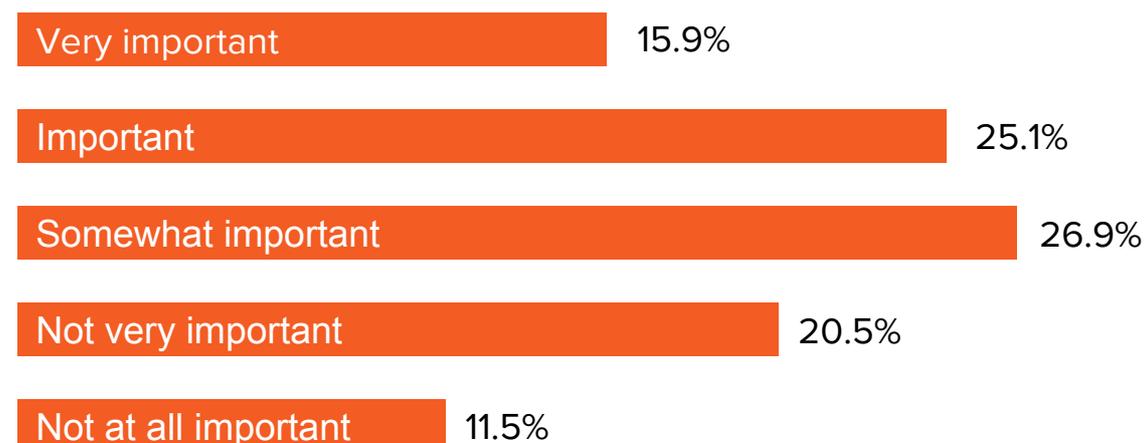


Some job vacancies list “IT Related Qualification” in their Candidate Requirements, which may be a good fit for those without a traditional degree. Sometimes, job vacancies related to the term “Developer” will only require a certain amount of experience, along with the other skills necessary for the particular job, such as Java or PHP. This is becoming more common as employers realise that special skills are essential requirements for effective processes within their company, maybe even more so than traditional qualifications.

However, a good grasp of the necessary skills will most likely go hand in hand with solid experience in a certain programming language, or the ability to solve complex object-oriented problems in a timely manner. One role may call for the ability to take on and manage entire projects very quickly, while another may require the stamina to work on a repetitive process for an extended period of time. It all depends on the specific role.

In summary, many job vacancies in South Africa do still require a B.Tech or BSc in Computer Science or Computer Engineering, and it is only time that will change the way the market views the importance of other qualifications, skills, and experience. In the meantime, online education can bridge the gap between tertiary education and employment due to the practical learning aspect of short courses. This is an area that has hugely benefitted global millennials in a fast-changing world, where educational providers need to stay relevant as industries advance. **Relying solely on traditional education methods** to train the workforce leaves workers vulnerable to skill and knowledge decay, and lets promising individuals fall through companies' gaps into career obscurity.

Importance of Formal Education to Current Software Developers



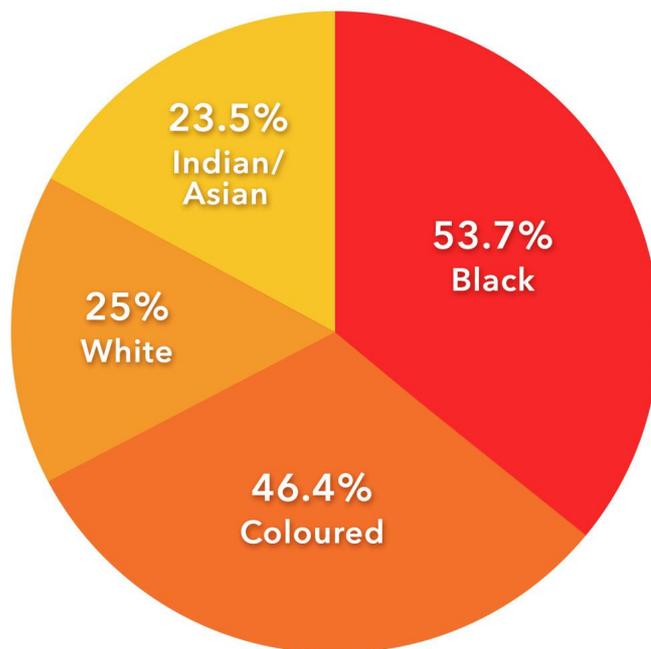
Globally, developers are moving away from formal education in favour of valuable skills, hands-on experience, and how well they fit into a particular role at a company. The 2017 [Stack Overflow Developer Survey Results](#) reveal that only about 16% of current professional developers surveyed say that formal education was very important to their career success. This makes sense in light of the 90% of developers who call themselves at least somewhat self-taught, highlighting that formal degrees are becoming outdated in the face of a dynamic and ever-changing global tech industry.

Traditional qualifications versus online education

As South Africa's tech industry expands it must also meet the needs of employers and potential employees - that means broadening perspectives on educating the next generation of developers. Internationally, online education has become incredibly important in educating people in the digital age, but South Africa still lags behind in terms of how we think of and treat people within the tech industry. Institutions take years to update their syllabi with essential learning areas that employers demand, while online training providers are constantly shifting and transforming to cater to future developers - a group as diverse and rapidly-evolving as technology itself.

Considering the amount of time it takes to follow a traditional study path, combined with the financial pressure a degree places on a student, it is no surprise that South African university drop-out rates are high. The [Department of Education and Training publishes an annual report](#) on the topic of graduate statistics, and this year revealed that 47.9% of university students do not complete their degrees. Statistically, [only around one in twenty black students go on to finish their degree](#),

compared with almost one in two white students. Fifty years ago the South African government was spending 16 times more on the education of a very small privileged portion of society, and fast-forward to today to see how oppressive policies have affected people's access to education.



**Unemployed youth
in South Africa**
(15-24 yrs old)

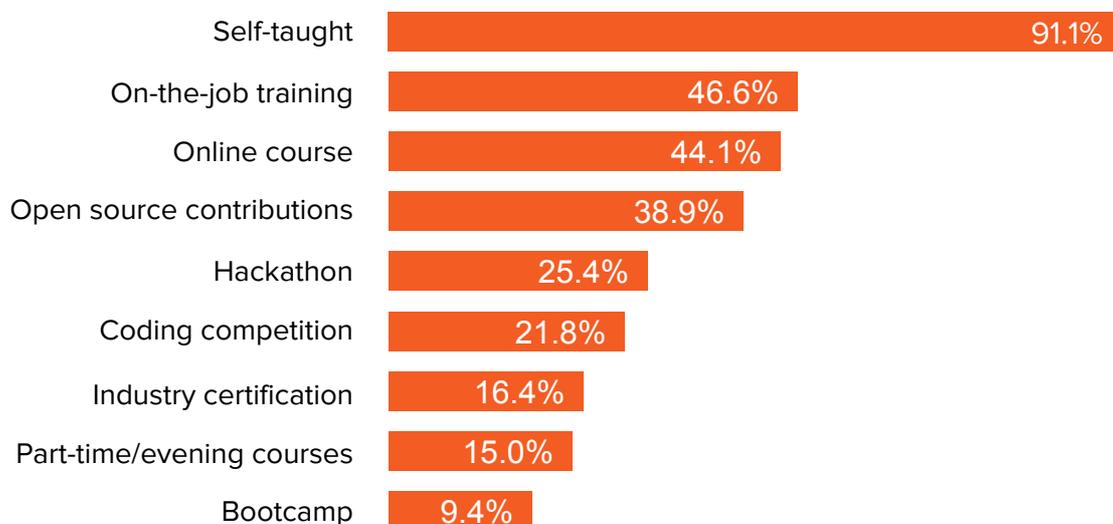
Institute of Race Relations 2016
South Africa Survey

Online education can help bridge the gap between these enormous inequalities. Studying a course online is not only more affordable than going to university, but also more accessible. There are still many barriers between disadvantaged communities and South Africa's flourishing tech industry, but one way to link the two is through building technological literacy outside major cities. While access to the Internet is still considered a luxury for many South Africans, someone from an underdeveloped area who may never have the opportunity to go to university still has a number of routes to access online education. Smartphones are also a significant tool for online learning, with recent research showing 34% of South Africans have phones that can access the Internet and applications.

On a global level, support for online learning resources is high. [A recent survey](#) asked 20,000 people from 187 countries about how they learned to code, and huge numbers stated that they found online learning helpful in their path to becoming a developer. They listed websites such as freeCodeCamp (77%), Stack Overflow (62%), W3Schools (54%), and Codecademy (53%) as beneficial to their learning journey, while only 38% of respondents had completed a Bachelor's Degree. Of that percentage, most hadn't studied a technology-related subject, further boosting the idea that becoming a developer is accessible to people from all walks of life. Furthermore, the [Institute of Race Relations 2016 South Africa Survey](#) shows that there are nearly half a million South Africans with a tertiary qualification who are currently unemployed, which only serves to prove that traditional education is not the quintessential qualifier in South Africa's modern job market.

Most professional developers have used other forms of education to assist them in their career paths. As seen in the table below, over 90% were self taught and over 44% using online short courses to assist in developing their skills.

Other types of education among professional developers



Source: www.stackoverflow.com



Learning online and in your own time is a form of self-empowerment, and this self-empowerment will be a vital tool in navigating South Africa's job market in years to come. Fashioning a background as a developer through online courses is just one way that people can leap into the future of technology and change the way the country absorbs talent into the workforce.

The Hyperion Team



We hope this report proved helpful and informative when considering software development as a career.

Hyperion Development offers online, part-time coding courses developed in partnership with the world's leading tech firms, taught by expert 1-on-1 mentors so you can learn faster and get hired sooner.

From web, software to mobile and everything in between.

www.hyperiondev.com

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