

Mentoring and coaching

INDIVIDUAL LEARNING relationships will typically manifest in mentoring and coaching relationships, but may also include other forms of relationships established for the purpose of human capital development (HCD). It provides mechanisms for knowledge transfer, talent development, behaviour modification, action learning and related HCD goals to maximise performance and personal achievement.

Dr Nkgatho Tlale believes South Africa has the talent to produce world-class mechatronics, but that we are lacking behind in terms of training. "Mechatronics, formerly known as robotics," he explains, "is the integration of three distinct areas, namely software, electronics and mechanical engineering. Each so-called robot comprises elements of each of the three fields of study. The challenge is in the integration of the three, to develop better systems."

Nkgatho Tlale



Keeping light hands on the reins

Professor Etienne Barnard is a research leader in the human language technologies research group of the Meraka Institute (a national research centre managed by the CSIR). Etienne has a PhD in electrical and computer engineering from Carnegie-Mellon University in the USA. Previously at the University of Pretoria, he now holds an academic position at North-West University.

ETIENNE IS A MAN of many talents, with expertise in artificial intelligence and pattern recognition, which find their application in human language technologies (HLT). Besides this, his interest and understanding extend to bioinformatics, which draws on the principles of artificial intelligence and pattern recognition. "There are distinct similarities between language and molecules of life – the latter has a sequential structure that we recognise in language," he explains.

Mentorship: what's in a name?

A dictionary explanation for mentor is a trusted friend, counsellor or teacher, usually a more experienced person. However, no formal definition exists for mentorship within the CSIR, "which is a good thing", says Etienne, "as it needs to be different

according to the particular context." Mentorship should assist a person with personal growth, and should be based on the mentor's own past experience. He notes, "The essence is the personalisation of the mentor's experience."

Mentorship: why?

Why is mentorship so important for the HLT research group? It ensures the pipeline of personal growth in the group, from undergraduate level to a Master's or a doctoral qualification. Etienne sees it as essential to capacity building "because we have ambitious goals in our group". The group is working on HLTs for all 11 official languages of South Africa. "This requires solutions to many different problems, which obligates us to work as a group of people with a critical mass," he reveals. It also ensures that graduates are able to make their way independently in a work-

ing situation at a later stage. "It is important to allow people to discover and learn," he observes. "Life skills acquired in this way are more likely to be embedded in an individual's growth and can serve to smooth the career development path." Etienne has experience both of academia and working in industry, which enables him to provide a balanced perspective.

Keeping the balance

An indubitable fact is that mentoring takes up time, particularly that of the mentor. Given the ideal ratio of one:one for mentorship, Etienne knows that the current situation in his group is 'an unbalanced tree': between him and research group leader, Dr Marelie Davel, they support 20 post-graduate students. "I'm convinced that our group will grow in maturity in the near future," he comments. "It is more ideal to have a research leader supported by more



Etienne with three of his protégés: (from left) Nicholas Zulu (PhD in electrical engineering); Aditi Sharma (Honours in technology management) and Gerrit Botha (Master's in electronic engineering)

HUMAN LANGUAGE TECHNOLOGIES

is also called language technology or natural language processing (NLP) and consists of computational linguistics (CL) and speech technology as its core but includes also many application-oriented aspects.

ARTIFICIAL INTELLIGENCE

refers to intelligence as exhibited by an artificial (man-made, non-natural, manufactured) entity.

PATTERN RECOGNITION

aims to classify data (patterns) based on either a priori knowledge or on statistical information extracted from the patterns.

BIOINFORMATICS

involves a number of techniques, including computer science and artificial intelligence, to solve biological problems, usually on the molecular level.

senior staff, who in turn support at least three or four students each."

Etienne is currently mentoring approximately 25 students, 15 of whom are at the Meraka Institute. Five are registered for PhDs while the remaining students are doing Master's qualifications or undergraduate internships. Their research fields span several topics in HLT, theoretical pattern recognition and bioinformatics. The students are registered at either the University of Pretoria or North-West University.

How to grow young researchers

The student pipeline, says Etienne, has a horizon of four to eight years; each year should therefore add another batch who will qualify with a PhD within the next period. Other opportunities abound for talented students: one of the Master's students at the Meraka Institute, Charl van Heerden, will be joining Google in May 2007 for a three-month internship in its speech-recognition group (which has

recently attracted much attention with its system for searching local information with a free local telephone call).

... and how to be a good mentor

The qualities of a good mentor are patience and the maturity to allow the protégé enough opportunity to discover and learn independently.

Etienne gave the following guidelines for those who are poised to become mentors:

- Draw the line between technical mentoring and career mentorship. "In the HLT group, these are not fulfilled by a single person," he points out.
- Draw on structures and systems to support the process. "It is conducive to good results," he notes. Once a week the HLT group has an engineering meeting to share information on projects and to find methods that are aligned with research goals. The reading group focuses on general topics in research, is voluntary

and aims to find groups to tackle a problem.

- "Don't spread yourself too thin," warns Etienne. "It's best to set parameters." He suggests that one should strive for the 'tree' model he mentioned earlier: "Hierarchies are helpful in this case."
- Find your personal style. This may be hands-on and informal (as in his case), but a more formal approach works better for other mentors.
- "Cultivate and search for ways to enthuse your protégés," he advises. "Areas of growth in scientific communities are those in which the social and working life converges. This becomes a way of life and a symptom of a successful enterprise."

Etienne calls himself "unreasonably focused on my scientific interests". He is fascinated by progress in science into the realms of the thinking process. "Once we understand the mysteries of cognition, we can utilise our powerful hardware to simulate these wondrous processes," he muses.

– Biffy van Rooyen

"Cultivate and search for ways to enthuse your protégés."

Dean Brady



Mentoring advice from the guru on the ground

Good mentoring is not about being a “guru at the top”, or so Dr Dean Brady of CSIR Biosciences believes – a philosophy he swears by and that has earned him much recognition as a mentor.

LAST YEAR, two months after taking the prize as the best mentor within his CSIR unit, Dean was crowned as the overall winner of the mentor’s award in the CSIR-wide Excellence Awards, a feat he takes in his modest stride.

The strategy

“These awards were an incidental by-product of working with people and building teams,” says Dean, pointing out that the uniqueness of each situation should also be taken into account during the judging process.

There is no fail-safe formula to developing the best in people, according to Dean. “Much of it is trying to work with people to bring out the best in themselves. It is about facilitation and these people are often

keen to achieve in the first place. Support them, give them confidence, don’t get in the way when you are not needed, and they are sure to achieve their goals,” he advises.

“People in a team should be learning from one another as well,” he adds. “You don’t want a situation where someone at the top is trying to run everything. You also want the individuals you are mentoring to be better than you as quickly as possible,” he says. Either way, it is clear that his philosophy does not include a ‘top-down’ approach.

His personal mentors

Dean credits two individuals for his mentorship style. His earliest influence came from observing his former PhD supervisor at

Rhodes University. “Professor John Duncan gave everybody the freedom to achieve what they wanted to and did not try to constrain people,” says Dean.

More recently, Dr Dusty Gardiner, a colleague at the CSIR, has provided a good example through “his habit of freely imparting information to all, leaving it up to people to decide if it is useful to them.” With the combination of these techniques, Dean has managed to create for himself a successful plan to help his team members achieve the best in their careers.

“I try not to create massive competition between people, but rather to cross-fertilise ideas and stimulate collaboration.” And this may be the reason why his group is rapidly expanding with 17 team members at present.



As a mentor, his track record is as impeccable as his *curriculum vitae*, which details a wealth of research and project experience, membership of seven professional councils and societies, evidence that Dean has been widely published in books, journals and has had papers published and presented at numerous conferences.

Dean has supervised and mentored numerous PhD and Master's students and researchers. Many of his former mentees have moved to higher positions outside the CSIR, such as Butana Mboniswa, until recently CEO of BioPAD. Dean's commitment to human capital development runs deep – in 2002 he proposed a plan for the CSIR to provide opportunities for post-doctoral researchers to develop biotechnology resources for the growth of the local biotechnology industry. This was supported with funding from the CSIR and co-funded by the Department of Science and Technology.

Leading from within the team

"As a mentor, he is not into micro-managing because he expects you to be at a level where you can do independent research and at a PhD level, most people want that," says Varsha Chibbha, a mentee who has benefited immensely from Dean's guidance. Varsha's involvement with the CSIR stems from her employment as an in-service trainee with African Explosives and Chemical Industries (AECI) in Modderfontein before part of the business was sold to the CSIR. In 1997 she

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was employed as a permanent lab technician at the CSIR and enrolled for the National Diploma in biotechnology. She worked with various research groups, eventually ending up in Dean's enzyme technologies group where biocatalysis is an important technique for achieving research aims. Varsha obtained her BTech and is currently studying towards a Master's degree in enzymology through the University of the Witwatersrand.

Joni Frederick, a PhD candidate, joined the CSIR as a part-time employee four years ago and also credits Dean as the source of her verve for self development. She remembers how – when she arrived as an Honours graduate – Dean allowed her to contribute towards a small project. "When I wanted to study further, he was willing to supervise me and let me choose a project. He is an extremely busy and stressed man, with a lot on his plate, but he'll always makes time for you," says Joni.

The man behind the mentor image

Dean's father, Alan Brady, an organic chemist, used to work in the CSIR's former road research unit. Dean joined the AECI 12 years ago as a researcher and became an employee of the CSIR (as a research

fellow and research group leader) through incorporation of AECI's research and development department into the CSIR. "It is ironic that I ended up at the CSIR too, quite unintentionally."

Explaining his choice of career, he says: "At university I had a choice: arts or science. From the way I looked at it, I could always start studying arts later, but in order to build a career in science, I had to start earlier." Science remains his first love both inside and outside of the lab as Dean also enjoys reading books about science. "I'm interested in history, the history of science and the interconnectedness of science. Very few things are completely independent. We depend on whole societies working together to achieve things."

– Asha Speckman

Facilitate and not dominate is a mentoring principle that Dean applies during all interactions with his mentees.



Mechatronics expert a passionate mentor

"ROBOTICS IS ACTUALLY a misleading word and does not do justice to the subject matter," Nkgatho explains. "As the professor explained to me on that Rubicon day, the proper term is mechatronics, the science of combining principles of software, electronics and mechanical engineering to produce efficient systems. Robotics is merely one of the many areas of applying computer science in manufacturing. My students and I prefer to think of ourselves as operating in a manufacturing environment, where we use information and communications technology and electronics and mechanical engineering principles to make processes and machines more efficient." Nkgatho specialises in the science of synergising these three components of mechatronics with the main focus on estimation and control theory.

Research group leader

Nkgatho joined the CSIR in early 2006 as a research group leader. In addition to having to give research direction, securing funds and ensuring suitable projects, he has to ensure that each project has the right people. "Unfortunately, no university in the country has a tailored undergraduate degree in manufacturing," he explains.

Dr Nkgatho Tlale became one of South Africa's leading robotics experts quite by chance. Upon completing his BSc (mechanical engineering) at the University of KwaZulu-Natal (UKZN), he decided to pursue a Master's degree in thermodynamics, but when he approached the faculty, he was informed that the professor was retiring. Very disappointed, he knocked on the door of the professor next door ...

"I can't just bring a student fresh from university and expect him or her to conduct research; I first have to mould the person. At the same time I encourage them to register for a Master's or PhD degree so that, by doing an academic project, they mature to another level of thought. I try to spend as much time as possible with each student to understand their passion and steer them in the right direction."

"We need role models"

According to Nkgatho, it is difficult to attract South African students to a research career in engineering. "Many of them are under the impression that a mechanical engineer is a motor vehicle mechanic, that engineering is a dirty job."

Adding to the problem is the challenge to convince a B degree student to pursue a Master's degree. "They don't have role models," he explains. "Our role models in science, engineering and technology should be much more visible in the community; like political or business role models."

"Young people cannot imagine themselves being researchers or academics because they don't know any successful people with whom they can identify who have such careers. I'm a typical example – I drive a Tazz," he laughs.

He believes it is also due to peer pressure – remuneration in research and academia is low compared to the business sector.

Attracting students to research

So how does one convince promising students to pursue a career in research? "I tell them there are two things in life, money and your happiness. Concentrate firstly on your happiness and the rest will follow. With a good academic foundation, you can find money anywhere in the world and dictate the lifestyle you want."

In this regard, Nkgatho leads by example. He finds deep satisfaction in solving problems and taking challenges head-on. "It is about pure self-actualisation, because I love what I do," he explains.

Education in South Africa

Nkgatho says while it is difficult to attract South African student interest in manufacturing, interest from other southern African students – especially from Botswana – is very high. "Botswana is a country with a much more persuasive and encouraging policy in terms of tertiary studies," he says. In his current student group, Nkgatho has students from China, Botswana and Zimbabwe.

How should universities and governments encourage postgraduate studies? "In an ideal world, tertiary education should be free. It is costing me some R35 000 per year to do my MBA, to develop myself to be a good leader, mentor and manager. In this context, I can't see how we are going to get postgraduates from the majority of South Africans who are so poor that they can hardly afford basic education. I had a school mate who was always among the top three academic achievers, but could simply not afford university. He had to support his six siblings, but used his salary to send all of them to college or university. These South Africans are the true heroes. They are my role models; it is from them that I get my defining moments."

Academic background

Nkgatho hails from academia. Seven years ago his research group from UKZN, which comprised three researchers, was invited to start up a mechatronics engineering programme in New Zealand at Massey University's Institute of Engineering and Technology. "The three years I spent there opened my mind to another dimen-



Seated around Sebastian, the omni-directional mobile robot, are (front left) Mark de Villiers, Dr Nkgatho Tlale, Ahmed Shaik, Bo Xing and Unathi Diniso. Sebastian can change its direction of motion instantaneously to any direction required. "Imagine a car without a steering wheel," explains Nkgatho, "where the direction of turn is achieved by special wheels that have rollers instead of threads. By changing the rotational speeds of the wheels, you are able to instantaneously change the direction of motion of the car to any direction required."



sion; it was truly enriching." In 2004 he decided to return home, and accepted a position at the University of Pretoria's Engineering Faculty where he taught until his appointment at the CSIR, where he soon started a mentorship programme to achieve his research objectives.

During his six years as an academic, Nkgatho was a PhD supervisor, reviewer of papers and presenter and main writer of international and local refereed conference and journal papers. As a result, he has an active network of research peers all over the world. He is also on the steering committee for Robonica CC, a project funded by the National Innovation Fund on the research, design and commercialisation of educational robotic systems.

A dedicated mentor

"For me, mentorship is a strategy," he explains. "I soon realised that the best approach would be to get students from different universities and, as a team, we get to grips with what is happening in our research area, link that with respective Master's projects and ultimately, of course, encourage staff to continue with their PhDs."

"Since it is difficult to get prospective students from industry, human capital development is a logical step; it is a

Is robotics/ automation counter-productive to job creation?

"South African companies cannot compete globally by insisting on manual labour for high tech manufacturing. It is just not sustainable. We also can't compete with cheap labour in countries like China, that uses automation on top of that. We must therefore compete on value addition. We must design products and add value to those products, and to do that, we need automation; a process that ultimately generates more jobs. If I had an automated manufacturing plant in South Africa that employs 100 people, statistically it would create work for 200 more people on a secondary level – through servicing (maintenance, selling, and others)," explains Nkgatho.

working strategy," he states. "But in all cases I believe you have to develop yourself first. If you have a strong academic and research base, it is so much easier to pursue the next step in your career."

– Renatè Janse van Vuuren