

Failure or Underachievement of the Gifted? Towards Understanding the Predicament of Disadvantaged in Engineering Studies

Dudzile R. Mkhize

University of Johannesburg, Johannesburg, South Africa

Abstract: This article is based on the prevalent low throughput rate which is a consequent of low performance of previously disadvantaged students who enter engineering studies at the South African universities. A different view from current research of resolving this problem is proposed. Research on the poor performance for these students tends to point fingers at external factors such as poor schooling for the disadvantaged. This article highlights the overlooked positive attribute about black engineering students, namely, their excellent academic achievement in high schools which gained them entry into the engineering programs at the university. Research on gifted education regards these students as exhibiting schoolhouse giftedness. Therefore, the article suggests that these youngsters are actually underachieving, which is a reversible phenomenon. In line with studies on the development of talent, nurturing environment and inappropriate self-theories are put forward as the factors for these students' underachievement. Furthermore, interpersonal expectancy effect theory is proposed as the basis for future interventions to address the problem of underachievement in engineering studies at the universities.

Keywords: Black engineering students, failure, gifted students, academic underachievement.

I. INTRODUCTION

The constitutional right to choose occupation and profession freely signalled a demise of the Job Reservation Act and Bantu Education Act of 1954 which had prevented black youth from becoming engineers. Hence, two decades of the South African democracy has seen black youth flooding the engineering studies in the country's universities. However, this has not translated into a similar increase of blacks graduating with engineering from the universities. For example, Fisher (2011) found a very low academic success of about 30% among engineering students. This is a serious problem for the country which is keen not only to transform its political, but seeks to develop its economy which is dependent on engineering skills. Consequently, one of the objectives of the National Development Plan is to increase the number of university graduates (National Development Plan, 2011). The challenge is how is this going to be achieved? Research which seeks to throw light on the factors causing low performance among black engineering students has been conducted. However, much of this tend to focus on external factors causing poor performance, that is, environmental factors for students such as the poor quality of education which is beyond the control of the affected students. Such research has overlooked the academic prowess of these students while they were in high school. This according to Renzulli (2012) is schoolhouse giftedness. Such ability can be controlled by its owners, if appropriate interventions are put in place. For example, interventions that reclassify black engineering students as gifted has the capacity of improving their academic self-efficacy as well as the expectation from their instructors. In this case, poor performance will be viewed as underachievement, which implies the students have the potential to achieve, but they are not doing so.

II. REVIEW OF RESEARCH EXPLAINING LOW ACHIEVEMENT OF THE DISADVANTAGED IN ENGINEERING

Seeking for answers for low academic achievement of the majority of the students assessment researchers have found that there is mismatch between the high school achievement and academic performance of students at the university (van der Merwe & de Beer, 2006). The high school achievement referred here are the results on the common examination, namely, National Senior Certificate (NSC) written by all country's students doing their final year in high school. Entry to South African universities is based on the achievement in NSC. Research views the achievement on NSC as a poor predictor of academic achievement at the university (Nel & Kistner, 2009).

This theory implies that high achievement in NCS has no bearing to the cognitive ability of the students. It is also noted that students cannot control the processes of their assessment.

Research on the second factor leading to poor performance by engineering students cites the cognitive deficit for students in engineering. For example, Loji (2012) asserts that the significant numbers of South African students lack problem solving skills in engineering studies, making it difficult for them to succeed. According to van Eeden, de Beer and Coetzee (2001), cognitive ability and learning potential are predictors of academic success. The lack of cognitive ability seem to imply the fixed nature of the students' ability, that is, students have it or they do not have it. In her many years of research, Dweck (1999, 2006) has shown the belief in the fixed nature of ability leads to poor academic performance. This view once more, throw students in an uncontrollable situation as the fixed cognitive ability means it is innate.

The third and popular research explaining the poor performance at the university is the prevalent inequalities in the education system for the poor students and well off students, the poor students being mainly the black (Nel, Troskie-de Bruin & Bitzer, 2009). This view asserts that impoverished blacks still have schools with insufficient resources such as support learning materials, school infrastructure as well as low quality teachers. Hence, the majority of black students go through poor education system which does not prepare them for success at the university. This factor does not point fingers at the students, but at the schooling system. Once more students cannot control their schooling system.

In response to the poor predictive validity of NSC and the poor schooling systems special programs designed to prepare students who had poor schooling to succeed in the mainstream engineering and science studies have been implemented in the first year of university, especially for engineering. Examples, include the Science Foundation programme (Grussendorf, Liebenberg & Houston, 2004).

The final research is mentioned for the sake of completion as it is not necessarily concerned with the factors for poor performance at the university. But it highlights the schooling system which is unable to produce adequate graduates in mathematics and science, which are essential for engineering studies. For example; Lawless (2005, p80) found that "The number of higher grade mathematics passes is not enough to satisfy the needs of science, engineering and technology and the financial professions. The few number of black higher grade passes in mathematics and science is severely hampering the transformation of science, engineering professions". According to Bernstein (2005) this situation is prevalent despite the government's efforts to improve.

"After 1994 the education authorities launched numerous initiatives aimed at improving mathematics and science. In 2001 the education department adopted a national strategy for mathematics and science and technology. Yet, despite the energetic commitment of government, NGO's (Non-Governmental Organisations) and the private sector over recent years, research shows that these initiatives have failed to impact the mathematic education system" (Bernstein, 2005, p.11).

Earlier, the department of education stated this as a legacy of apartheid education that needed to be changed. "Access to technological and professional careers requiring a strong basis in mathematics and science is denied to all but a fraction of the age cohort, largely because of the chronic inadequacy of teaching in these subjects" (Department of Education and Training, 1995, p.22).

In general most factors of poor performance discussed above seem to be all beyond the control of students. Adopting an external factor view for students' performance makes room for students not to take responsibility for their performance as this is not their fault. This will make it difficult if not impossible to have interventions that change this situation. It makes

sense for Hlalele (2010) to argue that interventions that have been put in place at the universities for disadvantaged students have not been effective in addressing the poor performance problem.

It is the view of this article that the overlooked research on the positive attribute associated with the black engineering students has the potential of giving students control on their achievement. The following section discusses this.

III. OVERLOOKED POSSIBILITY OF GIFTEDNESS AMONG BLACK ENGINEERING STUDENTS

Engineering programs at the South African universities are only available to students with NSC (National Senior Certificate) achievement in mathematics, science and English as well as the aggregate achievement meet the stringent entry requirement for these programmes. Table 1 shows four top levels of achievement for all subjects written in NSC.

Table 1: Levels of High School Achievement acceptable to engineering programs

Achievement Level	Achievement description	%
7	Outstanding achievement	80-100
6	Meritorious achievement	70-79
5	Substantial achievement	60-69
4	Adequate achievement	50-59

For example, one university for first year engineering, accepted students who obtained level 7 in mathematics, at least level 6 in science and at least level 5 in English. In general, for acceptance in engineering programs at the South African universities, students must have had at least levels 5 in both mathematics and science for their NSC. According to the National Senior Certificate Diagnostic report, the performance trend in mathematics for the period of four years (2010-2013), less than 18% students who wrote NSC obtained more than 40% in mathematics and about 15% in physical science. There is a high probability that learners who achieved 60% and above in both mathematics and science are less than 10% of the high school learners who wrote national senior certificate examination. Hence, students who enter engineering programs are among the top achievers in mathematics and science. Such achievement is called schoolhouse giftedness.

According to Renzulli (2012, p.151); "The first type of giftedness is called high achieving or schoolhouse giftedness, referring to students who are good learners in traditional school achievement". He defines the other type in terms of the high scores obtained by students from intelligence tests. Taking into cognisance the country's history on intelligence tests, for example, Ficks Scale which were used to justify cognitive superiority of the whites to other races (Foxcroft & Roodt, 2011) school house giftedness is viewed as an acceptable option to identify giftedness. Therefore, the black engineering students are gifted because they were admitted based on their high academic achievement in high school.

Being gifted implies that these students do have the cognitive ability to continue achieving academically, but they are underachieving. The predicament of the gifted among the disadvantaged is well captured in the following: "If gifted underachievers are not meaningfully accounted for in conception of giftedness and talent, it is highly unlikely that underachievers will be effectively sought. This is especially so for gifted underachievers from cultural and social minority groups where giftedness is often heavily masked" (Chaffey, 2009, p.106). In view of the discussed factors for their poor performance, clearly, disadvantaged students are not regarded as gifted. It is also noted that the underachievement of the gifted when they transit to university is prevalent (Mendaglio, 2013). The good news is underachievement for the gifted is reversible (Baum, Renzulli & Hebert, 1995).

IV. PROPOSED FACTORS FOR UNIVERSITY UNDERACHIEVEMENT OF THE SCHOOLHOUSE GIFTED

Taking the view of the black youngsters whose achievement in high school was such that they qualify to enter engineering studies at the universities, factors for their underachievement at the university should be investigated with a view to find appropriate interventions. Two factors for underachievement will be discussed; these are lack of nurturing environment and self –theories that mitigate against achievement. Finally, the Pygmalion –in classroom effect as a consequence of recognising the giftedness of disadvantaged students will be proposed as a strategy to reverse underachievement.

A. Lack of nurturing environment as factor for underachievement

Underachievement is regarded as a threat for the gifted (Reis & McCoach, 2000; Baker, Bridger & Evans, 1998). Varied factors have been cited for this. But, most of these are within the students' locus of control. For example, Reis (2009) asserts that some students underachieve for obvious reasons such as excessive absence from school, disruptive behaviour, disruptive behaviour and low-self-esteem. It is the view of this article that underpinning all these is the lack of nurturing environment for gifted students. If a nurturing, warm and supportive environment is provided for students, it is highly unlikely that they will be absent from school, engage in disruptive behaviour. But more importantly, a nurturing environment will enhance their self-esteem.

The nurturing environment for the gifted forms the very core of giftedness for most contemporary researcher in this field. For one thing the old debate of whether giftedness is a product of nature or nurture. According to Claxton and Meadows (2009), Charles Darwin argued that almost everyone is born with the ability to be bright. However, it is the environment that pushes individuals to work hard and to develop the zeal that will enable them to merge as gifted and talented in their own way. In fact, Claxton and Meadows assert that innate and unchangeable giftedness should be excluded from educational practices as it incorrect, inhuman and counterproductive. In agreement to this view, Sternberg (2009) also maintains; "One is not born gifted, rather giftedness in wisdom, creativity, intelligence, and creativity is to some extent a form of developing. To support this perspective, Hymer (2012, p.111) asserts; "Gifts and talents are grown and created in an individual's response to and interaction with her physical, social and intellectual environment".

Therefore, the debate of nature or nurture seem to be more applicable when identifying the gifted. But, clearly, when it comes to development and actualising the potential, nurture plays a more important role than nature.

Chan (2009) puts forward a case for nurturing the nature by narrating a story of a gifted youngster who marvelled his community by his gift of literary ability during his childhood. But, he was so obsessed with his fame that he never went to school to develop his talent. As he grew, he became ordinary!

B. Unsuitable self –theories as a factor for underachievement

As high achievers in high school, school adopt some form of belief about their abilities. Dweck (1999, 2006) have researched and called these the mind-set theory. It the belief about the nature of one's intelligence, gifts and talents, which Dweck finds to have a powerful impact on one's sense of self-efficacy. According to Pintrich (2003, p.671); "students who believe they are able and that they can, are more likely to be motivated in terms of effort, persistence, and behaviour than students who believe they are less able." Much has been researched and said about self-efficacy. Maddux (2002) asserts that self-efficacy has the power to control one's environment. Also, one of the quotes by Mahatma Gandhi alludes to self-efficacy; "If I have the belief that I can do it, I shall surely acquire the capacity to do it, even I may not have it at the beginning".

Dweck argues that self-efficacy is based on whether students believe their intelligence or capability is malleable or fixed. The belief that intelligence is malleable can lead a student to exert effort, apply new strategies in the face of difficulties and hence grow new skills and capacities, while doing this achievement is inevitable. Whereas the belief that intelligence is fixed can lead a student to adopt passive and avoidant stances in the face of challenges. Such avoidance approaches are supposed to shield and protect the perceived fixed capability because if they try and fail, the existing intelligence has been disproved! So students who believe they have fixed giftedness would rather not try, than try and fail. Hence, these students open themselves to high probability of failure! For students who have been celebrated as top achievers

mathematics and science in their final year of high school, adopting a belief of fixed intelligence is tempting as this says one is a natural genius which seems nobler than being a hard worker!

Unlike the nurturing environment which is dependent on the instructors, professors and the university staff in general, students can change their belief about the nature of their abilities.

V. PROPOSED REVERSAL OF FACTORS FOR UNIVERSITY UNDERACHIEVEMENT

It is the belief of this paper that if the academic environment is nurturing, underachievement of the perceived gifted can be reversed. Supporting this view Hymer (2012, p. 113) states, “Gifts are grown in relationship of trust, warmth and mutual respect, not in an emotional vacuum”. The interpersonal expectancy effects theory is viewed as being the most relevant basis for interventions aimed to reverse underachievement among the black schoolhouse gifted students at the university.

The interpersonal expectancy is based on the Pygmalion-in the classroom study by Rosenthal and Jacobson (1968). According to Baron, Branscomber and Byrne (2009) this study is one of the classics of social psychology. In this study the teachers were told that a group of students had scored very high in an IQ Test and were about to bloom. Even though this was not true, the teachers’ behaviour towards the students was so nurturing and supportive that the students did bloom and ended up developing skills that were non-existent in the first place. All this, despite the fact that these students had average scores on the said IQ test. Therefore, this showed that teachers and instructors’ high expectations from students can affect the way they provide the academic supporting environment.

According to Rosenthal (1994) this has been confirmed by more than 800 subsequent studies interpersonal expectancy effects. From these a four factor theory of the mediation of teacher expectancy factor had been proposed. The four factors are divided into central factors which include climate and input factors. What this means teachers with high expectations of their students create a warmer socio emotional climate for their students and they give more positive input to students. Additional factors include output and feedback where output means teachers give students more opportunities for responding that is, to give outputs. Finally, feedback teachers give students more informative feedback to their students. The last one, that is, the informative feedback, reminds the author of a lecturer who when requested by the student to go through the assignment so as to identify weaknesses which led the student to barely pass the assignment, responded with a curt and cold; “You must read your notes carefully and with understanding”! Is this what the students are subjected to on a daily basis? What hope can they have for ever achieving to their full potential, if they are given such non-informative feedback even when they ask for it?

VI. CONCLUSION

This paper has made a case that research on the factors for the failing or poor performing disadvantaged students is overlooking a critical positive aspect of this problem. These students fit in the definition of schoolhouse giftedness, hence their problem is reversible underachievement! This alone puts forward the notion that these students are cognitively capable, positing a paradigm shift in the manner in which poor performance has been studied thus far. Perceiving students as gifted has the potential of raising higher achievement expectations from their instructors, as has been proved over years by Rosenthal’s classic Pygmalion in the classroom study.

In view of the importance of effecting the much needed transformation for equal opportunity for all to choose engineering as a profession, research aiming to make this happen should explore all avenues. This paper has proposed a different avenue. Just like positive psychology introduced a paradigm shift from the obsession of psychology with what is abnormal among human beings, to the strengths that human beings exhibit (Seligman and Csikszentmihalyi, 2000), research on failing black engineering students need to change focus. As has been argued in the paper underachievement is reversible since the potential to achieve is a given. Jesse Jackson (1978, p.193S) promulgated; “If the victimizer is responsible for the victim’s being down, the victim must be responsible for getting up”. Self-theories give the students the responsibility to change their beliefs and hence the efforts they invest in their studies. Equally, interpersonal expectancy effect gives the custodians of these students at the university, the responsibility to provide a nurturing environment for the actualisation of talent already exhibited in high school among black engineering students.

REFERENCES

- [1] Baker, J.A., Bridger, R. & Evans, K. (1998). Models of underachievement among gifted preadolescents: The role of personal, family, and school factors. *Gifted Child Quarterly* Winter, 42, 5-15
- [2] Baron, R.A., Branscomber, N.R. & Byrne, D. (2009). *Social psychology*. (12 ed.), Boston: Allyn & Bacon.
- [3] Baum, S.M., Renzulli, J.S. and Hebert, T.P. (1995). Reversing underachievement: Creative productivity as a systematic intervention. *Gifted Child Quarterly*, 39, 224-235
- [4] Bernstein, A. (4 October 2007). Maths and science teaching: SA can't afford to fail. *Business Day*, page 11
- [5] Borland, J.H. & Wright, L. (1994). Identifying young, potentially gifted, economically disadvantaged students. *Gifted Child Quarterly*, 38, 164-171
- [6] Chaffey, G.W. (2009). Gifted but underachieving: Australian indigenous children. In T. Balchin, Hymer, B. & Matthews, J. (Eds.), *The Routledge International Companion to Gifted Education* pp106-111. New York, NY: Routledge
- [7] Chan, D.W. (2009). Lay conceptions of giftedness among the Chinese people. In T. Balchin, Hymer, B. & Matthews, J. (Eds.), *The Routledge International Companion to Gifted Education* pp.115-121. New York, NY: Routledge
- [8] Department of Education. (1995). White Paper on Education. *Government Gazette*. (Vol.375, No.45621). Republic of South Africa.
- [9] Dweck, C. (1999). *Self-theories: Their role in motivation, personality and development*. Florence: Psychology Press.
- [10] Dweck, C. (2006). *Mindset: The new psychology of success*. New York: Random House
- [11] Fisher, G. (2011). *Improving throughput in the engineering bachelor's degree*. Bruma: ECSA
- [12] Foxcroft, C., & Roodt, G. (2011). *Introduction to psychological assessment in the South African context*. (3rd ed). Cape Town: Oxford University Press Southern Africa.
- [13] Grussendorf, S., Liebenberg, M., & Houston, J. (2004). Selection for the science foundation programme (University of Natal): development of a selection instrument. *South African Journal of Higher Education*, 18(1), 265-272
- [14] Hlalele, D.J. (2010). Do learning skills acquired in the university access programme enhance participation in academic practice? *South African Journal of Higher Education*, 24(1):98-110
- [15] Hymer, B.J. (2012). An act of GRACE? What do contemporary understanding in psychology have to contribute to the future of the gifted? *Gifted Education International*, 29(2), 108-124
- [16] Jackson, J.L. (1978). In pursuit of equity, ethics, and excellence: The challenge to close the gap. *Phi Delta Kappa International*, 60(3), 189S-193S.
- [17] Lawless, A. (2005). *Numbers and needs: Addressing imbalances in the civil engineering profession*. Halfway House: South African Institution for Civil Engineering.
- [18] Loji, K. (2012). Toward teaching methods that develop learning and enhance problem solving skills in engineering students. *South African Journal of Higher Education*, 26(1), 120-135
- [19] Maddux, J.E. (2002). Self-efficacy: the power of believing you can. In C.R. Snyder & S.J. Lopez (Eds.), *The Handbook of Positive Psychology* (pp 277-287). Oxford: Oxford Press.
- [20] Mendaglio, S. (2013). Gifted students' transition to university. *Gifted Education International*, 29(1), 3-12
- [21] National Planning Commission (2011). *National development plan 2030*. Pretoria: Department of Education.
- [22] Nel, C., & L. Kistner (2009). The National Senior Certificate: Implications for access to higher education. *South African Journal of Higher Education*, 23(5), 953-973.

- [23] Nel, C, Troskie-de Bruin, C. & E. Bitzer (2009). Students' transition from school to university: possibilities for a pre-university intervention. *South African Journal of Higher Education*, 23(5), 974-991.
- [24] Seligman, M.E.P. & Csikszentmihalyi, M.(2000). Positive psychology: An introduction. *American Psychology*, 55(1), 5-14.
- [25] Sternberg, R. (2009). Wisdom, intelligence, creativity, synthesized: a model of giftedness. In T. Balchin, Hymer, B.& Matthews, J.(Eds), *The Routledge International Companion to Gifted Education* pp255-264. New York, NY: Routledge .
- [26] Reis, S.M. & McCoach, D.B.(2000). The underachievement of gifted students: What do we know and where do we go? *Gifted Child Quarterly Summer*, 44, 152-170.
- [27] Reis, S.M. (2009). Turning points and future directions in gifted education and talent development. In T. Balchin, Hymer, B. & Matthews, J.(Eds), *The Routledge International Companion to Gifted Education* pp317-324. New York, NY: Routledge.
- [28] Renzuli, J.S.(1978). What makes giftedness? Re-examining a definition. *Phi Delta Kappan*, 60(3), 180-184.
- [29] Renzuli, J.S.(2012). Re-examining the role of gifted education and talent development for the 21st century: A four-part theoretical approach. *Gifted Child Quarterly*, 56(3) 150-159.
- [30] Rosenthal, R.(1994). Interpersonal expectancy effects: A 30 –year perspective. *Current directions in psychological science*, 3(6) , 176-179.
- [31] Rosenthal, R. & Jacobson, L. (1968). *Pygmalion in the classroom: Teacher expectation and student intellectual development*. New York: Holt, Rinehart & Winston.
- [32] Pintrich, P.R. (2003). A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology*, 95 (4), 667-686.
- [33] Van der Merwe, D. & M. de Beer (2006). Challenges of student selection: predicting academic performance. *South African Journal of Higher Education*, 20(4), 547-562.
- [34] Van Eeden, R; de Beer, M. & Coetzee, C.H. (2001). Cognitive ability, learning potential, and personality traits as predictors of academic achievement by engineering and other science and technology students. *South African Journal of Higher Education*, 16 (1), 171-179.