

Academic Behavioural Confidence of First-entering Mathematics and Science University Access Program Students

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ABSTRACT The current study seeks to gain insight into the Academic Behavioural Confidence (ABC) of first-entering university access program students intending to enroll for mathematics and science degree programs at a historically disadvantaged campus that was incorporated into a historically White university. The study adopts a quantitative-descriptive (survey) design. The respondents, 169 university access program students, completed the questionnaires on their own, at the same time and the author was present to respond to concerns raised. This measure ensured that respondents did not collude and give responses that were not authentic and secured a hundred percent return on the questionnaires. The study found that a significant difference can be expected amongst individuals than between groups of different ages, gender groups whilst a lesser difference can be expected between different home languages. On the whole, a significantly high level of academic behavioural confidence was discovered for the respondents. This clearly indicates that, should the *ceteris paribus* principle apply, these students are likely to perform well academically.

INTRODUCTION

It has been generally accepted that academic performance in any subject, depends on, critical elements such as confidence. The South African education system experiences a number of challenges, including below par performances in national and international benchmark tests. This implies lower academic expectations and success. When things get tough for students in higher education they need the self-belief that they can succeed, that is, confidence or else they may be likely to give up. Pulford and Sohal (2006) maintain that while self-perceptions of academic competence have been investigated in children, little is known about how higher education students perceive their academic strengths. The *Oxford English Dictionary* (1989) defines confidence as "having a strong belief, firm trust, or sure expectation; feeling certain, fully assured, self-reliant; having no fear of failure". Sander and Sanders (2005) maintain that confidence differs between people in the same situation and that people have differing levels of confidence in different situations. Thus, someone who is highly confident in a familiar setting, for example, may lose confidence in an unfamiliar and challenging environment. Access program students are likely to consider the university environment as unfamiliar and challenging on at least two levels. Firstly,

the fact that a university operates differently from high schools in many respects, may result in self doubt and lower confidence levels. Secondly, the feeling that access program students did not meet criteria for admission and may not gain access to university after all, aggravates the lack of confidence. Access programs comprise developmental courses whose purpose is to empower the students in order to cope with demands (academic in particular) in higher education.

The identification of students with the potential to succeed in mathematics- and science-based studies despite previous educational disadvantage is a critical issue currently facing many South African higher education institutions (van der Flier et al. 2003). The former Department of Education and Training (DET) Black students' educational disadvantage is greatest in mathematics and science. In the South African context, previously disadvantaged schools are schools belonging to the previously black-only educational systems, which typically have few qualified science and mathematics teachers and inadequate or non-existent physical facilities (Arnott et al. 1997). As a result, most South African Black matriculants still do not qualify for entrance into science-based higher education courses on the basis of their matric results. According to Rutherford and Watson (1990), a C-symbol (60–69%) grade 12 aggregate score is

generally regarded as necessary for a student to have an adequate chance to succeed at university. The purpose of the study was to investigate ABC first-entering university access program students according to gender, age and home language.

CONCEPTUAL FRAMEWORK

Academic Behavioural Confidence (ABC) is a construct that refers to the students' beliefs that they can perform competently in a particular learning situation. Students become motivated when they believe that they can be successful in learning new material and performing new tasks. Confidence relates to self-efficacy and contributes to achievement (Sanders and Sander 2007). Confident students have been found to be better able to attain goals than students who do not have confidence in their own abilities (Bandura 1977; Jones 1977).

In accordance with Bandura's (1986: 25) Social Cognitive Theory, "what people think, believe, and feel affects how they behave. The natural and extrinsic effects of their actions, in turn, partly determine their thought patterns and affective reactions." Albert Bandura further argued that: "educational practices should be gauged not only by the skills and knowledge they impart for present use but also by what they do to students' beliefs about their capabilities, which affects how they approach the future. Pajares (2000: 2) and Bandura (1982, 1997) posit that students who develop a strong sense of self-efficacy are well equipped to educate themselves when they have to rely on their own initiative." Bandura's argument provides a thought for researchers to ponder what to do to students in order to influence their future actions.

The current study is located in the first of Chickering and Reisser's (1993) seven vectors, that is, developing competence. The 'developing competence' vector covers both the acquisition of particular intellectual, physical, and interpersonal skills (the three tines in Chickering and Reisser's pitchfork analogy) as well as the confidence one feels in those skills (the handle of the pitchfork which is crucial to the development of a strong sense of competence). In fact, the current study investigates the academic behavioural confidence (the handle of the pitchfork) of first-entering access program students. The study aims to inform what can be done to these stu-

dents by investigating their ABC on arrival at university. ABC can be described as confidence in one's academic and intellectual abilities in general as well as confidence in particular aspects of that ability (for example, mathematical ability or problem solving skill). In the current study, ABC is closely related with aspects of an adapted Sander and Sanders' (2003, 2006) Academic Confidence Scale (ACS). Incidentally, no other measures are used at this institution to determine the students' ABC.

RESEARCH METHODOLOGY

Approach: The current study is primarily exploratory in nature. An exploratory study is conducted to gain insight into a situation, phenomenon, or community or individuals (Bless and Higson-Smith 1995). The need for such a study could arise out of a lack of understanding on a new area of interest, or in order to be acquainted with a situation (Fouch 2005). This study seeks to gain insight into the ABC of mathematics and science university access program students. The study further draws on descriptive attributes of professional research. It presents a picture of specific details of a situation, social setting or relationship (Neuman 2000).

Design: Mouton (2001) defines a research design as a plan or blueprint of how one intends conducting the research. Huysamen (1994) views it as the plan according to which data are collected to investigate the research hypothesis or question in the most economical manner. The study adopts a quantitative-descriptive (survey) design. A questionnaire with eight areas of learning skills and at least four statements in each of the areas on a five-point Likert scale (strongly agree to strongly disagree) was personally administered on 169 mathematics and science access program students. Sander and Sanders (2006) developed the ABC scale for use as a survey instrument to assess the confidence that higher education students have in their own anticipated study behaviours in relation to their degree programme. The ABC scale was used as it had already been tested for internal reliability by its developers. The instrument was also used at a South African University of Technology by Matoti and Junquiera (2009) and found it to be valid and reliable. The target population was access program students at one historically disadvantaged campus which was incorporated into a

historically white university in South Africa. The respondents completed the questionnaires on their own, at the same time and the author was present to respond to concerns raised. This measure ensured that respondents did not collude and give responses that were not authentic and secured a hundred percent return on the questionnaires.

Research Questions: The main goal of the current study was to gain insight into the academic behavioural confidence of first-entering mathematics and science university access programme students. In order to address the main goal, the following questions were derived:

- ♦ Is there any difference in ABC between male and female first-entering mathematics and science university access program students?
- ♦ Is there any difference in ABC between first-entering mathematics and science university access program students of different ages?
- ♦ Is there any difference in ABC between first-entering mathematics and science university access program students of different home languages?

Hypotheses: The research problems stated above were investigated by testing the following null hypotheses:

- Ho1:** There is no significant difference in ABC between male and female first-entering mathematics and science university access program students.
- Ho2:** There is no significant difference in ABC between first-entering mathematics and science university access program students of different ages.
- Ho3:** There is no significant difference in ABC between first-entering mathematics and science university access program students of different home languages.

RESULTS

The results were presented through analysis of variance (ANOVA) tables. Tables 1, 2, 3 and 4 present results according to respondents' gender, age, home language as well as their confidence in various aspects of academic behavioural confidence, respectively.

Table 1: Respondents' gender

	Sum of squares	Df	Mean of squares	F	Sig.
Between group	.914	1	.914	3.598	.060
Within group	42.412	167	.254		
Total	43.325	168			

A one-way ANOVA was used in analysing confidence levels according to respondents' gender. In the case presented above, post hoc tests were not performed as the study consists of two groups (males and females). As the hypothesis (*Ho1*) of the study states, that there is no significant difference in academic behavioural confidence in gender groups. The sum of squares between both males and females was .914 which reflects differences as compared with the "within group differences", with the total sum of 43.325. Between groups frequency of 3.598 is reflected. The significance found from the analysis in this study is .060, which is slightly above .050 (Table 1). According to Hannula et al. (2004) gender differences favouring males in confidence in mathematics are well recorded. From an early age, boys estimate themselves to be better than girls in mathematics (Bohlin 1994; Hannula and Malmivuori 1997; Pehkonen 1997; Vanayan et al. 1997; Matoti and Junquiera 2009). Leedy et al. (2003) further found that the traditional gender confidence in mathematics prevail even in mathematically talented (intelligent) students. *H₀1* cannot be supported.

The respondents were divided into two groups according to age. Group 1 was constituted by students younger than 21 years and group 2 by students older than 21 years of age. A one-way ANOVA was used in analysing confidence level according to age group. Sum of squares between groups was 0.883 and within groups 42.443, these figures indicate the difference between groups and within groups. Means of squares between groups were 0.883 and 2.254 within groups, with the frequency of 3.473. A small significance of 0.64 surfaced (Table 2). This means that a significant difference can

Table 2: Respondents' age

	Sum of squares	Df	Mean of squares	F	Sig.
Between group	.883	1	.883	3.473	0.64
Within group	42.443	167	.254		
Total	43.325	168			

be expected amongst individuals than between groups of different ages. The null hypothesis cannot be supported.

A one-way ANOVA was used in analysing confidence level according to group home language. The majority of respondents belonged to the Sesotho and Isizulu home language groups. The sum of squares between groups was 0.708 and 42.617 within groups, adding to a total of 43.325. Mean squares between groups was 0.354, whilst within group was 0.257. The level of significance was 0.255, which reflects a slight difference in confidence level in relation to home language (Table 3). The slight difference may be accounted for by the different schools the students come from. Furthermore, the fact that the difference in confidence in accordance with home language was not significantly greater is due to their almost homogeneous background. The majority of students enrolled at this institution come from schools that are predominantly rural and located in low socio-economic areas (eastern Free State and northern Kwazulu Natal). The null hypothesis (H_0) is supported.

Table 3: Respondents' home language

	<i>Sum of squares</i>	<i>Df</i>	<i>Mean of squares</i>	<i>F</i>	<i>Sig.</i>
Between group	.708	2	.354	1.380	.255
Within group	42.617	166	.257		
Total	43.325	168			

Even though the respondents evinced significantly high levels in the majority of ABC aspects, we need to be concerned about lower levels of confidence (means lower than 2, see Table 4) in some of the crucial aspects of participation in academic practice (epistemological access). Low levels of confidence were in asking for help if the students don't understand, being on time for lectures, making the most of the opportunity of studying for a degree at university, as well as attending most lectures, tutorials, and practicals. In comparison with the ABC of students in the Humanities, and Economic and Management Sciences access programs, the ABC for the students in mathematics and science access programs is significantly higher (Hlalele 2009, 2010; Hlalele and Alexander 2011).

Table 4: Means of various aspects of ABC (n=169)

<i>Statements</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>
Ask lecturers questions about the material they are teaching, during a lecture	168	3.64	1.91
Respond to questions asked by a lecturer in front of a full lecture theatre	169	3.21	1.79
Ask lecturers questions about material they are teaching, in a one-to-one setting	169	2.73	1.65
Follow the themes and debates during lectures	169	2.60	1.61
Engage in profitable academic debates with your peers	169	2.55	1.60
Understand the material outlined and discussed with your lecturers	169	2.54	1.59
Pass assessments at first attempt	169	2.45	1.56
Attain good scores/marks in your modules/courses	169	2.44	1.56
Read the recommended background material	169	2.43	1.56
Plan appropriate revision schedules	169	2.36	1.54
Write in an appropriate academic style	168	2.35	1.53
Manage your workload to meet coursework deadlines	168	2.34	1.53
Prepare thoroughly for lectures as well as tutorials	169	2.32	1.52
Produce coursework at the required standard	169	2.31	1.52
Remain adequately motivated throughout the year	169	2.27	1.51
Produce your best work under examination conditions	169	2.26	1.5
Give a presentation to a small group of fellow students	169	2.23	1.49
Study effectively on your own.	169	2.20	1.48
Produce your best work in assignments	168	2.07	1.44
Attend tutorials	169	2.07	1.44
Seek appropriate support when the need to do so arises	169	2.04	1.43
Ask for help if you don't understand	169	1.89	1.37
Be on time for lectures	169	1.72	1.31
Make the most of the opportunity of studying for a degree at university	168	1.72	1.31
Attend most lectures, tutorials as well as practicals	169	1.60	1.27

DISCUSSION

The main goal of the current study is to gain insight into the academic behavioural confidence of first-entering mathematics and science university access program students in accordance with age, gender and home language. According to Table 4, students showed a fairly significantly high level of confidence in many

(21 out of 25) aspects (means of 2 and above on a 4-point Likert scale). Parsons et al.'s (2009) study found that students' confidence in their ability in mathematics was shown to have significant relations with academic performance. Students with the lowest grades in school were generally least confident and least successful in mathematics. However, optimists suggest that there is always room for improvement. Support needs to be provided for the students with the least confidence as well as those with high confidence. Pajares (2000) strongly recommends the creation of classroom climates in which academic rigour and intellectual challenge are accompanied by the emotional support and encouragement necessary to meet that challenge. Inculcating ABC and positive attitudes towards mathematics and science amongst females remains a challenge. Mensah (2007) stated that the females expressed positive attitudes toward science as an indication that when classroom environments are made conducive to both males and females, and girls are frequently exposed to women role models, more girls will take up the challenge to study science at the higher levels.

The importance of ABC cannot be over-emphasized. Students who are confident work harder, evaluate their progress more frequently, and engage in more self-regulatory strategies that promote academic success (Pajares 2002). Furthermore, these students are also able to monitor their work on time, are more efficient problem solvers, and show more persistence than do equally able peers with low confidence (Pajares and Urdan 2006; Ulsher and Pajares 2006a, b). This study revealed that students intending to enroll for the mathematics and science degree program evinced generally higher levels of confidence for all respondents (Tables 1 to 3) as well as in various academic aspects of ABC (Table 4). According to Bandura (1977, 1982, 1997), students' ABC beliefs are key determinants of human behaviour and they powerfully predict performance. The study concludes that, should the *ceteris paribus* principle apply, students intending to enroll for the mathematics and science degree program are more likely to attain their academic goals.

Consistent with the Attribution Theory, lecturers and academic development staff can help students to increase their confidence by encouraging them to see learning as a result of their own efforts and strategies (McCown et al.

1996). Warwick (2008) advocates feedback as an invaluable aid to boosting students' confidence. Warwick suggests that giving students feedback on particular aspects of the work when deserved (not just a general 'well done') enhances efficacy as it (efficacy) stems from successful completion of more difficult tasks and making students aware that competence and ability are changeable and can be developed through practice and experience. Dealing with the fear has also been found to be vital in boosting students' ABC (Siyakhanyisa 2009).

CONCLUSION

The need for mathematics and science graduates remains a challenge. This study revealed heightened ABC levels in students who would have otherwise not been admitted to university. Even though this presents a positive and somewhat encouraging picture, much still needs to be done in order for the students to successfully complete their qualifications. Studies have shown that there is no difference in the abilities of either gender or racial groupings to overcome their fear of mathematics and science and achieve the same results. More and more psychologists and mathematicians are agreeing that you have to deal with the fear before you can expect anyone to master mathematics.). Therefore, teachers, both at school and universities, can make a difference in the academic achievement of their students.

NOTE

For the purpose of this article, access programme refers to an alternative programme for students from disadvantaged backgrounds who failed to meet university entrance requirements. Access programmes have been developed to address two issues: (1) the need to increase access/widen participation for disadvantaged student who do not meet university entrance requirements and (2) to prepare these students for the rigours of higher education.

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