

A comparison of the responses of science talent quest (Expo) students and research students in education to the question: *Why am I doing research?*

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ABSTRACT: This study focused on the question, *Why am I doing research?* The samples of respondents were 172 aspirant young scientists/technologists who exhibited their projects at the 2005 Cape Town schools' Science Talent Quest (Expo) competition, plus 45 adult novice postgraduate research students in education at the University of Cape Town, Cape Town, South Africa. It was hypothesised that the response patterns would closely mirror each other in some ways, but differ in other respects, possibly reflecting differences in age or status. Both samples responded to 11 literature-derived reasons/motivations for starting research investigations, which were presented in Likert-scale formats. More in-depth open-ended questions and interviews were then conducted with selected researchers who offered amplified responses and explanations. Three main differences were found between the samples. Firstly, the development of skills and abilities was rated as significantly more important by the adult novice postgraduate research students. Secondly, the decision to commence a research project to fulfil other people's expectations and directives was rated significantly higher by the adult novice postgraduate research students. Thirdly, anticipation of better future job prospects was rated as significantly more important by the younger sample.

INTRODUCTION

There is a growing realisation that the path to national prosperity depends fundamentally on a highly skilled workforce to grow the South African economy and to improve living standards in a competitive and rapidly changing global market. Hoosen Rasool, chief executive of the Clothing, Textiles, Footwear and Leather Seta (Sector Education and Training Authority) commented recently that the challenge facing tertiary institutions is to accelerate graduate rates in scarce occupations – science and engineering – in the context of a problematic South African schooling system [1].

He continued:

Within the national education and training system there are deficiencies that must be addressed as a matter of priority in order to build a highly skilled workforce ... The extent to which we address these deficiencies will determine our success as a nation. The acquisition of reading, writing, maths, science, communication and problem solving competencies through the schooling process is fundamental to productivity and flexibility at all levels of employment [1].

He went on to point out that the most frequent criticism voiced by employers and firms is that South African school-leavers have unacceptably low levels of literacy, numeracy and science skills. Improving the quality of schooling, especially in languages, mathematics and science, is the first priority for policymakers and schools alike. The starting point of a productive workforce is, therefore, productive schools.

In an attempt to respond to the challenge, the Department of Education's Revised National Curriculum Statement Grades R-9 Policy: Technology (2002) for schools has been founded on

an outcomes-based approach to education [2]. The three Learning Outcomes in the Technology Learning Area are specified as follows:

- *Learning Outcome 1: Technological Processes and Skills:* The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies;
- *Learning Outcome 2: Technological Knowledge and Understanding:* The learner will be able to understand and apply relevant technological knowledge ethically and responsibly;
- *Learning Outcome 3: Technology, Society and the Environment:* The learner will be able to demonstrate an understanding of the interrelationships between science, technology, society and the environment.

A second initiative is the Expo competition for aspirant young scientists, technologists and inventors in schools, held annually at the University of Cape Town, in which enthusiastic learners attempt to achieve one or more of Learning Outcomes 1, 2 and 3 in their presentation of a self-initiated research project carried out to completion over a period of many months.

ORIGIN OF THE PROBLEM

I feel as if my idea can change South Africa, and help in the long run to First World status, was the response of a junior entrant, 15 years old, in the 2005 Cape Town schools' Expo competition when asked to explain why he had decided to conduct a research investigation and enter it in the annual talent quest for aspirant young scientists, technologists and inventors. He went on to point out that he took part in Expo because it was what he himself wanted to do – not because other people expected him to enter. He explained that he liked working with unknown things and also enjoyed the freedom, flexibility, skill, inquisitiveness, challenge and independence offered by Expo as a non-routine activity in his daily life.

In response to the question, *Why are you doing a research project for Expo?*, three other senior high school entrants in the same competition remarked:

- *I don't think there should be any person living in a shack. I mean, the advantages of it are none. I think I can make a difference of any kind.*
- *I am doing this project because we saw people in Joe Slovo [squatter camp] have got problems. Then we wanted to find out what were their needs at the moment.*
- *I always help other people. When I was small I felt helpless – abusive father.*

The idea that young South African students might initiate research projects *because it was part of their activist agenda for the post-apartheid emancipation in South Africa* was a notion that had not appeared explicitly in the formal research literature. Perhaps the closest identifiable notion that resembled it was *altruism* [4].

Further informal discussions with several teachers, who were pursuing dissertation Master's degrees in education at the University of Cape Town in 2005, also disclosed that their post-apartheid intentions were to utilise their current opportunity for research study in order to pursue and actively promote freedom, justice, equality and democracy in the educational workplace or in their local community. They said they wanted to overcome and change oppressive conditions in schools, give active voice to marginalised, destitute, abused or suppressed people, and so on.

Conversational comments such as these prompted the development of the study reported in this paper. It sought to build on the existing international literature, while also investigating the possible importance of the *local context* as an additional factor in the decisions taken by South African youth and their teachers to initiate relatively lengthy research investigations for presentation as formally externally examined research reports.

BACKGROUND

A review of the literature suggested that the decision taken by students to make research an important part of their lives might occur for a variety of reasons [3-7]. These are as follows:

- *Personal interest:* Research investigations give a student the chance to explore one or more aspects of issues that are of great individual or personal interest;
- *Career move:* Research qualifications and publications form the stepping stones to a sought career. Many careers in education and most academic careers require research publications and a research degree. Undertaking research work might lead to more career moves;
- *Following somebody's example:* The student has relatives or friends who are successful researchers, so there is a desire to emulate their example;
- *Other people expect the student to do research:* The locus of control for the decision is external to the investigator himself or herself;
- *Research is attractive to the sort of person who prefers to avoid the real world:* Conducting research gives more independence, freedom and flexibility than most jobs (even though it does not pay very well!). It also offers the chance to remain in academic life rather than take work outside the university;

- *The student cannot find another job, or it is difficult to find one:* Research experience might increase the chances of a student being appointed to jobs he/she would like to secure. Meanwhile, doing research gives the student time to decide exactly what he/she wants to do next;
- *Developing skills and abilities:* Conducting research provides many opportunities for a student to develop skills and abilities that are transferable to other career and life situations. Some of these might include: problem-solving, using initiative, working independently, sifting through information, and making decisions;
- *Undertaking research is enjoyable:* The student investigator has already had research experience, and knows that this is one of the most interesting, fascinating and exciting ways of spending time. In fact, the student is already hooked!
- *Personal challenge, ambition and a drive to be successful:* Research work is for people who are ambitious, vain or proud, and who have a strong personal desire to succeed. They enjoy, or seek to enjoy, being called *Doctor!* They want to get to the top of the educational ladder, and a research degree is the route to take. They strongly desire to prove to themselves that they can do it. They like fame and a real challenge in life;
- *They like working with the unknown:* The student is not frustrated by uncertainties and puzzles, and is persistently curious and inquisitive by nature;
- *Altruism:* The student wishes to use research to further good and noble ideals.

These findings, therefore, constituted the base on which to construct and develop the current investigation.

PURPOSE

The first objective of this research was to compare and contrast the responses of two samples of novice researchers – innovative secondary school science learners and teachers in a Master's degree programme – to 11 possible derived reasons for initiating a personal research investigation, such as the one in which they were already deeply involved.

The second purpose was to explore in more detail the possible relevance of the research being part of students' long-range goals for emancipation in South Africa (eg using their personal investigations to pursue and promote freedom, justice, equality and democracy actively in the workplace or community, to overcome and change oppressive conditions in society, or to give voice to marginalised and suppressed people). To achieve this second objective, an exploratory 11th item was added to the 10 already extracted from a review of the current literature.

METHODOLOGY

The Instrument

To produce quantitative data – with the intention of gauging the relative importance of the choices selected by the respondents – it was decided that participants in the study would be invited to commence by rating the literature-derived reasons for conducting research, framed for their particular context. This first section of the questionnaire would be of a closed nature and contain Likert scales. The second section would then elicit open-ended responses. Seeking both content and construct validity, the first drafts of the questionnaire were piloted, critiqued, modified, improved and amended in 2004 by

18 teachers in a postgraduate research methods course at the University of Cape Town. The task was presented as a class-based activity exercise seeking consensus. It was at this stage that an 11th Likert scale, the South African item, was added.

A contextually-based questionnaire prepared for the Expo students. When administered to large samples of adult novice researchers and Expo student researchers in 2005, the response data to the quantitative section of the questionnaire subsequently yielded Cronbach alpha reliability coefficients of 0.76 (n = 45) and 0.75 (n = 155).

Samples and Data Collection

Sample 1 comprised 172 aspirant young scientists, technologists and inventors who entered the 2005 annual Expo competition held at the University of Cape Town, 155 of whom completed the questionnaire voluntarily at the time that they were publicly exhibiting their work. They presented original investigations on a wide range of topics in engineering (chemical, metallurgical, mining, mechanical, civil, industrial, electrical and electronic), computer sciences and applications, design technology, innovation and development, earth sciences (geology and geography), energy, marine sciences, astronomy and space sciences, architecture, housing and settlement studies, recycled materials, environmental sciences and ecology, eco-tourism, agricultural sciences, mathematics and statistics, physics, chemistry, plant and animal sciences, medical science and health care, as well as food sciences.

Sample 2 comprised 45 adult postgraduate education students (mostly teachers and college/technikon lecturers) participating in several coursework modules on educational research design and methods in 2004-2005. They were preparing research proposals and actively conducting research in mathematics education, science and technology education, medical education, language and literacy studies, adult education, curriculum studies, educational administration, planning and social policy, educational management and leadership, higher education studies, teaching and educational psychology.

Several days after completing the first section of the questionnaire, these research methods students were assigned a follow-up task. They were requested to interview fellow students who had circled either 0 or 5 for any item, during which they recorded their peers' oral explanations and reasons in Section 2 of the questionnaire on worksheets. Respondents were then handed the transcript of what the interviewing peer had written, and the interviewees were then asked to verify that the essence of what they had said had been faithfully recorded.

RESULTS AND ANALYSIS

Some of the main findings were as follows:-

- For the 45 postgraduate education research students, of the 11 presented Likert scales, the item receiving the highest mean score (4.32 out of 5) was:

Doing research provides lots of opportunities to develop skills and abilities which are transferable to other career and life situations. Some of these skills might include: problem-solving, using initiative, working independently, sifting through information, and making decisions.

For the 155 Expo students, this item was deemed to be second in importance (mean score 3.82 out of 5), but the lower rating by this sample is statistically significant ($p < 0.05$). Data obtained from the interviews with the postgraduate education research students and from the open-ended section of the questionnaire support the importance of this reason for initiating a research investigation:

- Teacher A: *The skills and abilities I will learn will make a difference in my field of study;*
- Teacher B: *I feel we have to develop interventions that respond to the specific needs of the specific communities.*

- For the 45 postgraduate research students, of the 11 presented Likert scales, the item receiving the second highest mean score (4.24 out of 5) was:

My research investigation may give me the chance to explore one or more aspects of an issue that is of great personal interest to me.

However, for the intact sample of 155 Expo students as a whole, this item received the highest response rating (mean score 4.06 out of 5):

My research investigation has given me the chance to explore one or more aspects of an issue in science/mathematics/health/engineering etc. that is of great personal interest to me.

Data obtained from the interviews and from the open-ended section of the questionnaire support the importance of this reason for initiating a research investigation:

- Teacher C: *I am older, but that is not important. What is more important is that I am in a position to work in areas that interest me;*
- Expo student A: *I thought of it as something different and interesting to do;*
- Expo student B: *I am very interested in the sciences and I like to research environmental problems. Expo is a wonderful learning experience and great exposure for us;*
- Expo student C: *This project is done for personal interest, as I am passionate about it.*

- The overall responses of the two samples to the eleven presented Likert-scale items correlate very strongly ($r = 0.89$; $p = 0.0003$; $n = 11$). Both teachers and Expo school students appear to agree on the relative importance of the 11 reasons offered for doing research.
- Many statistically significant correlations, of the order of 0.50, were obtained between the responses to the Likert-type items on the questionnaire. A particularly interesting finding was the highly significant correlation obtained for the responses to the pair of items *Research is part of my agenda for emancipation in South Africa* and *I enjoy doing research*.

Data obtained from the interviews and from the open-ended section of the questionnaire support the importance of item 11 as a reason for initiating a research investigation in South Africa. For example:

- Teacher D: *There are many things wrong with South African society – racism and inequality;*

- Expo student D: *To promote freedom in South Africa: people to be equal to other races; must not judge each other.*

• For the item, *Other people expect me to do research*, the postgraduate education students scored a mean of 1.93, whereas the Expo students ranked this reason lower, with a mean score of only 1.30. This difference is statistically significant ($p < 0.05$). Nevertheless, data obtained from the interviews and from the open-ended section of the questionnaire support this reason for initiating a research investigation, in some cases:

- Teacher E: *I am persuaded by my colleagues, family and professors;*
- Teacher F: *I have no interest in HIV education – it's where the [research] money is;*
- Expo student E: *This was a school project that was required for our term mark.*

• The decision to commence a research project *in order to fulfil other people's expectations and directives* was rated significantly higher by the adult novice postgraduate research students.
• *Anticipation of enhanced future job prospects* was rated significantly greater in importance by the sample of young, aspirant scientists.

A CASE STUDY

The second author of this paper is a Master's student specialising in language and literacy education. She is studying the responses of apprentices to innovative intervention programmes for adults seeking to improve their technical and communication skills in farriery, saddlery and harness-making in Cape Town, South Africa. These *second chance* skills programmes are offered through *Project African Dawn*. The ancient arts and technical skills are taught within a working environment, through class work study in equine anatomy using animal parts, and then through in-the-field experience with live animals.

This Master's degree research project is located within the framework of the Government's National Education and training system's upskilling programme. The aim of the research is to evaluate the efficacy of the *Project African Dawn* apprenticeships offered by the International League for the Protection of Horses, in association with the Cart Horse Protection Association. She comments:

I chose my research topic for three reasons:

• *I am passionate about horses.*
• *I am a language and literacy student in adult education, so the main thrust of my research will be towards the apprentices' use and understanding of key words, such as technical terms.*
• *The apprentices are generally from communities which were previously disadvantaged economically, educationally and socially as a result of the previous South African government's inadequate education system.*

Hence, the reasons for my decision to become a research student fall into four of the previously mentioned categories:

• *I have a strong personal interest in, and commitment to, the research topic I have chosen;*
• *My research study is located in the real world of daily practice and job creation;*
• *Altruism (compassion) is a key aspect of my approach to research;*
• *The opportunity to contribute to the development and improvement of many under-privileged people in the new South Africa is one of the strong motivations for my choice of research topic.*

CONCLUSION

For the sampled postgraduate novice research students in education, there is evidence that their motives for initiating a research study prioritise the opportunity to develop generic, transferable skills and abilities. These include problem-solving, using initiative, working independently, sifting through information and making decisions. Their second strongest source of motivation is personal interest in a particular research topic.

For the sampled Expo students, the priority motives are reversed. They relish the opportunity to explore aspects of science and technology that are of great personal interest to them as individuals. They rate the acquisition and development of skills and abilities as second in importance.

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