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## Research into human cognition, attitudes, and beliefs requires a social sciences approach

### Submitting the report as a 'commentary' may inadvertently have had potentially unintended consequences

Because Prof Natrass submitted this scientific study<sup>1</sup> as a 'commentary' (which it was not) and the SAJS accepted it as such, two matters may inadvertently have contributed to the furore that followed publication. Firstly, as a 'commentary' this scientific article was not reviewed. Some of the obvious flaws that would have been picked up by reviewers and corrected by the author prior to publication of the article, were therefore missed. Secondly, the 'commentary' format, necessarily brief, led to several omissions that may have escalated the already serious flaws in the methodology of the research and the way it was reported: i) it was too short to accommodate the necessary conceptual or theoretical framework that should underpin, motivate, and explain research involving humans in a society, and ii) vital information about the methods used (such as the logic behind the sampling method, and its shortcomings) was missing. Natrass acknowledges and explains some problems in her subsequent longer responses<sup>2-3</sup>.

Perhaps the Editorial Board needs to reconsider its policy about what articles can be accepted as 'commentaries'. While the journal's policy states that '*the summarised results of research projects, or comments on such research findings, that have direct policy implications and/or immediate social value*'<sup>4</sup> will be published, the scientifically flawed research in the abbreviated commentary submitted by Professor Natrass would never be used as a basis for policy change or be of immediate social value.

### The investigation about humans in a social setting used an inappropriate scientific research approach

A fundamental drawback of the Natrass research is that, in spite of the author's later denial that '*the exploratory research was not designed to produce scientific research output*',<sup>2</sup> it is a truncated report of a scientific investigation, prematurely published. It reveals the psycho-statistical mind-set common to scientists, based on the assumed objectivity of the researcher, and focussing on hypothesis testing, cause-effect relationships, consensus-seeking, and generalisation. However, humans are not organisms like seeds or plants, with variables that can be investigated scientifically. Humans are idiosyncratic individuals whose beliefs, attitudes, and behaviours are influenced by a complex web of factors that are fundamentally affected by people's life experiences. These factors are typically referred to and investigated as 'variables' in scientific research (Natrass stating<sup>1</sup>, for example, that '*The key outcome variable was whether students had ever considered studying zoology or the biological sciences*'). Investigating a limited number of variables

over-simplifies the complex reality of humans in their social settings. The sheer number and nature of the human factors involved result in 'confounding variables' in scientific investigations – variables that cannot be controlled or accounted for. Such studies may simplify the investigator's understanding of the complex factors but are inadequate for explaining humans' beliefs and behaviours. The conclusions from such studies are thus often fundamentally flawed. It is little wonder that the reported study showed that '*all the regression models left a great deal of the variation unexplained*'.<sup>1</sup>

### **Understanding human behaviours and reasoning is best researched using social sciences approaches**

Research involving human participants is more appropriately conducted as social sciences investigations, as implied by Nattrass in subsequent correspondence<sup>2-3</sup>. Social sciences researchers would be likely to build on a conceptual framework based on a thorough knowledge of the relevant literature, including pertinent psychological theories pertaining to humans and the constructs being investigated. Such a framework would have fundamentally changed the motivation for the study, the design of the research, the interpretation of the findings, and the tone and wording of the reported research. Professor Nattrass's commentary does not mention the ethics protocol followed, a necessary requirement for university researchers. University social sciences research involving human participants would have required an ethics application to be submitted to a human research (non-medical) ethics committee made up of members from appropriate research fields, who could make informed decisions about the proposed research. Members of such a committee would have applied specific requirements that include, among other factors, respect for the rights and dignity of participants as humans; an appropriately worded motivation for the study; suitable research questions to guide the research; and carefully designed instruments (particularly their wording). The survey wording would probably be based on prior

open-ended interviews so that students' views, rather than the researcher's seemingly uninformed ideas, could be used to structure the survey instrument. The ethics committee would have returned to the applicant for rewording, poorly worded survey items such as leading questions and ambiguous double-questions (e.g. '*national parks should be scrapped in favour of giving land to the poor*'<sup>5</sup>).

### **The importance of identifying appropriate factors to investigate, based on experience and prior research**

The wording of the published commentary suggests that the study was based on unsubstantiated speculation ('*A large part of the answer is obviously ...*', '*Yet there are likely to be other reasons too ...*', '*The survey ... explored these possibilities*'<sup>1</sup>). Although Nattrass makes an effort to substantiate her thinking in her later, longer responses<sup>2-3</sup> the lack of a suitable explanatory conceptual framework makes these appear biased and unconvincing. Of fundamental importance when the researcher is not in the field being investigated is consultation with people who are experienced in the field. Consultation with veteran biology educators would have revealed that some of the fundamental assumptions that led to the research questions for the 'commentary' lacked validity or were unsuitable to investigate as variables likely to provide the researcher with answers to her questions. More importantly, experienced biology lecturers could have identified factors more likely to contribute to student's choice of what to study, so these could be investigated, for example, the impact of admired family members, teachers, or mentors, who made biology seem exciting or were in biology-related careers. Language-related issues also play a critical role for students learning science through a medium of instruction that is not their mother tongue<sup>6-7</sup>.

Biology lecturers would also have been able to point out that a faulty assumption guided the study, reflected in the title, that '*... biological sciences subjects struggle to attract black South African students*'<sup>1</sup>. A check on the facts would have shown i) that many black experts

occupy biology-related careers<sup>5</sup>, and ii) that the representation of black students in the convenience sample from UCT was radically different to that of other South African universities<sup>5,8</sup>, which typically comprise 80% to 90% black students. Furthermore, using a convenience sample rather than a stratified random sample means the interviewers may not have spoken to students who did chose to study biological sciences, whose replies would have shown the researcher where her interpretations of the data were flawed.

### Three factors contributed to the invalid conclusions

***Inappropriate use of correlations to assume causation, a basic flaw in logic.*** Correlations do not imply a cause-effect relationship between two variables, so any cause-effect relationships claimed will not be valid. Furthermore, because of this any claims based on assumed causation cannot be used for predictions (e.g. *'Agreeing that 'humans evolved from apes' was the second biggest predictor of considering studying biological sciences, 'showing that attitudes were better predictors' 'Materialist values (a key determinant of not desiring a career in conservation'<sup>1</sup>).*

***Incorrect generalisation of the results from a specific sample to the whole population.*** For example, by stating *'Table 1 shows that less than one third of black South African students reported having considered studying biological sciences ...'<sup>1</sup>* falsely implies that all black South African students were consulted. Inappropriate overgeneralisations, often involving wording using present tense reporting and plural nouns, and lacking the definitive adjective 'the' when referring to the sample, appeared to be a major factor contributing to the angry responses to the 'commentary'.

***Unsubstantiated, speculative explanations.*** The absence of a conceptual framework (based on a thorough understanding of the literature or theories of human psychology) makes the tentative explanations provided in the commentary seem like speculative flights of fancy. Without providing a theoretical foundation, or evidence from the students

themselves, the article claims that believing that humans evolved from apes was probably because of poor schooling and strength of religiosity. Other highly speculative claims<sup>1</sup> attributed lack of interest in studying biology to *'materialist values and aspirations ...experience with pets and attitudes towards wildlife ... likely also to be shaped by a student's socio-economic background'*; that *'black South Africans may be interested in .... the higher-paying occupations (accountancy, law)'*; and that *'interest in conservation as a career and in studying biological sciences might increase as the black middle-class grow'*.

### In conclusion

A number of problems may have contributed to the strong public outcry following the publication of the commentary. These include the inappropriateness of prematurely publishing an exploratory, preliminary study; doing so under the guise of a 'commentary'; using a scientific rather than a social sciences research approach; omitting the essential conceptual / theoretical framework to justify and interpret the study; providing insufficient methodological details to allow readers to judge the quality of the work; the overt methodological problems visible in the scanty information provided; the over-generalised claims made from a specific convenience sample; the unfounded conclusions that have been drawn; and the apparent lack of attention to ethical matters. As mentioned by one staff member in the rebuttal being submitted by the School of Animal, Plant and Environmental Sciences at the University of the Witwatersrand *'academic freedom has its limits. Its limits begin where unjustified claims and flawed assumptions and conclusions are made which may continue stereotyping blacks in an offensive way. Academic freedom does not free SAJS broadly from upholding ethical standards for any published pieces'*.

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