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Identifying and addressing factors affecting academic success of at-risk biology students: attitudes, work-habits and metacognitive knowledge

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ABSTRACT

Successful tertiary-level education in the biological sciences is crucially important in providing a high-level work force for a number of careers. The government of South Africa has realised the strong positive correlation that exists between the availability of scientific and technical human resources, the viability of the economy, and the well-being of its people. However, despite government policies and tertiary institutions efforts in South Africa to increase enrolment and improve students' throughput, the pass rates at first-year university level remains low, a source of concern for the government and affected institutions. The low pass rates of first-year students in the biological sciences at tertiary institutions constituted the problem which prompted the study.

The aim of this study was to identify factors perceived to be essential for academic success in first-year biological sciences at the University of the Witwatersrand, South Africa, and to investigate the effects of a computer-based programme designed to address some of the factors. The programme was developed to help students increase their awareness of appropriate attitudes, metacognitive knowledge and work-habits, all of which contribute to achieving academic success.

The study had two main phases, a "diagnostic" and a "therapeutic" phase. The research methods adopted in this mixed-methods study included the use of interviews and questionnaires to elicit information from various stakeholders.

In the diagnostic phase, interviews were used, first to elicit the perceptions of 10 lecturers teaching first-year biology courses, 8 Honours students, and 17 undergraduates, at the University of the Witwatersrand, about factors they believed influenced academic success. The five top-ranked factors influencing academic success identified were *being motivated*, *using appropriate study habits*, *having positive attitudes to studies*, *asking for help and clarification*, and *managing time effectively*. Whilst the above-mentioned were the common factors identified by the three samples, each stakeholder group made its distinctive contributions. Secondly, to obtain a wider perspective of first-year students' views, a questionnaire focussing on attitudes, work-habits and metacognition was administered to two large groups of students (n=145; n=100) at the end of two consecutive years. In this replicate study the three top-ranked factors in both studies had to do with academic behaviours: *attending all lectures; taking accurate notes*; and *asking for help and clarification when a topic was not understood*.

Eighty-three first-year students provided data on students' changing perceptions at the beginning and end of the year. This data was used to determine if, without an intervention, a year at the university influenced students' perceptions about appropriate factors affecting academic success. Rasch analytical techniques applied to 27 items in the questionnaire yielded 11 responses which were statistically significantly different. These responses were later addressed in the package because students needed this information from the start of their studies.

During the therapeutic phase a computer-based instructional programme, *Bioskills*, was designed to inform student users about attitudes, behaviours and metacognitive factors the literature and stakeholders said were important for academic success. Six experts and 75 first-year students provided comments as part of a formative evaluation during its development. These were used to modify the screen design, user interface and content of the alpha version of the package. *Bioskills* proved very easy to use, even for first-time computer users.

A case-study approach was used to explore the experiences of eight students with *Bioskills*, in particular its influence on their attitudes, metacognition and academic behaviours. All eight students made positive comments, saying it was relevant, informative and encouraging. Six out of the eight recommended it be used much earlier in the year, whilst two said it took too much time to work through. Without trying to imply causation the four students who used *Bioskills* three or four times passed the course.

Students' metacognitive gains were reported in terms of metacognitive knowledge [what students know about successful learning] and metacognitive control [the application of the knowledge]. The small sample size (n=8) made it difficult to detect trends. However, individual students mentioned new attitudes (*being more determined*, showing more *interest* in the topic and applying more *positive attitudes* to their studies) which they claimed they learned from using *Bioskills*.

Attribution is traditionally explained as *a search for understanding of causes*. Students' attributions on specific academic tasks are therefore important in the remediation efforts by educators. Of the 38 factors identified by the eight students, as causes for poor performance in their June examination, before they used *Bioskills*, almost two-thirds, when categorized using attribution dimensions, were of *internal* but *unstable* dimensions. The literature suggests it is easier to remediate causes that are internal and unstable rather than external and stable. After using *Bioskills*, four of the eight students who performed well at the end of a teaching block ascribed their success to the effort they had put in, whilst two of the four who did not do well, blamed external factors (the length of the test, the question structure) as contributing to their poor results.

The important contribution this study made was the theoretical framework developed which expanded the existing attitude-behaviour models by adding additional constructs and showing the relationships between them. In addition, a summary of factors mentioned by the stakeholders and supplemented with views from the literature were used to propose a conceptual model of factors influencing academic success. The thesis concludes by discussing the implications of the constructs in the model for improved academic performance and as an area for further research.