

# Evolution of the 3rd Year Major Project at the University of the Witwatersrand

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**Abstract.** The Major Project has been an important component of the 3rd Year Physics curriculum at the University of the Witwatersrand (WITS) for many decades. It has proven very popular with the students and has allowed academic staff to identify students with research potential as early as the final year undergraduate level. Student numbers have increased dramatically since 2015, and in 2018 the major project underwent a transformation, and since then students have completed an Independent Research Essay (IRE) under supervision of a member of the academic staff, with student teaching assistants providing support. The IRE may be used to inculcate or enhance essential skills for budding scientists, be they enrolled students or graduate student tutors.

## 1 Introduction

The final year physics undergraduate curriculum in institutions of higher learning should be designed to equip students with sufficient background to proceed to post-graduate study, and should also take note of the number of students that will not continue with their studies following successful completion of a bachelor's degree. Examination of the literature in Physics Education Research (PER) shows that the vast majority of studies are aimed at addressing teaching and learning at first year level. While PER studies of higher-level courses are rare, studies that focus on laboratory curricula are even less common. In the recent past, reports by Zwickl *et al* [1, 2] have attempted to provide laboratory coordinators with guidance as to the design and implementation of innovative higher-level laboratory programmes.

A description of the Physics III curriculum at WITS has been provided previously [3]. In brief, the curriculum comprises five modules. The Major Project is part of the Advanced Experimental Physics and Project (PHYS3006) module, and it contributes approximately 50% of the final mark for the module, and a significant portion of the final mark for Physics III. The activity has always been extremely popular with the students, who have cited it as the most stimulating component of PHYS3006 in several course surveys over the years [3]. Any changes that are made to the format of the Major Project should be designed to enhance the skills required for graduating students who are proceeding to post-graduate study, and those who will be making their way into the workforce [1].

This presentation seeks to provide the reader with a description of the evolution of the Major Project component of PHYS3006 for the period 2011-2021. While the initial impetus for considering and implementing changes is the remarkable increase in student numbers (see Fig. 1), it will be shown that the changes that were made provide the students with the opportunity to develop certain high-level skills that will benefit their future careers. The opportunity for the teaching assistants, who support small groups of students, to develop supervision skills, is a useful by-product of the changes that were made to the Major Project.

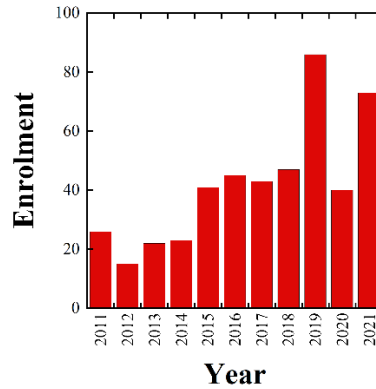


Fig. 1 Student enrolment for PHYS3006 for the years 2011 to 2021. The precipitous increase in student numbers prompted the change in the format of the Major Project, which is described in Section 2.

## 2 Comparison of the Major Project models

A comparison of the two models for the Major Project is shown in Fig. 2. Essential details are provided in the figure caption, while fine details will be provided in the presentation.

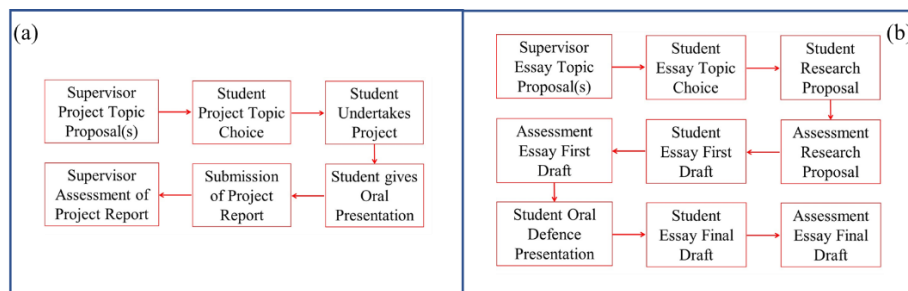


Fig. 2 A comparison of the two models for the Major Project using flow diagrams. Fig. 1 (a) shows the one-to-one relationship between the supervisor and the student. Additional detail is provided in the text. Fig. 1 (b) shows the IRE model for the Major Project. The model provides two aspects that the original model did not provide organically. Firstly, the assessment of the IRE is quasi-continuous, in that four student submissions are assessed. The second is the participation of graduate students. These teaching assistants act as mentors to a small group (between five and eight students), and thus develop useful “supervision” skills.

## 3 Summary

A precipitous increase in student numbers has persuaded the School of Physics at WITS to review the model for the Physics III Major Project that has been in use for decades. A model involving an Independent Research Essay (IRE) was introduced in 2018. The IRE allows for a continuous assessment of a student’s written skills. The introduction of teaching assistants into the project, with the title of essay tutor, allows the teaching assistant to gain invaluable experience of the process of successful supervision.

## References

- [1] B. M. Zwickl, N. Finkelstein N and H. J. Lewandowski, *Am. J. Phys.* **81** (2012) 63-70.
- [2] B. M. Zwickl, N. Finkelstein and H. J. Lewandowski, *AIP Conf. Proc.* **1413** (2012) 391-394.
- [3] J. M. Keartland, *Proceedings of SAIP2012: the 57th Annual Conference of the South African Institute of Physics* (2014) 418-423 ISBN: 978 1-77592-070-0.