Reflections on the Ethical Content of the IT Honours Program Project Module

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Abstract. Honours programs in South African universities must include a research project module. There are external pressures from professional bodies and government that influences the nature of the project module. This paper presents a reflection on the process of managing the project module at a South African university taking into account internal and external demands. The focus for this paper is on the ethical content of the projects. Examples of projects are presented after which the ethical awareness of the students is discussed. Not all projects have ethical, legal or social issues, however ethical aspects need to be reflected upon and awareness of these issues is essential during the planning of the project. The awareness that students have on ethical, social and legal issues is investigated in this paper.

Keywords: IT curriculum · Honours project · Research project · Artefact · Information security · Ethics · Social issues · Professional issues · Legal issues · Security awareness

1 Introduction and Background

For many years the honours program in IT, that follows after a three-year bachelor's degree in IT, included coursework as well as a practical project. Currently the honours program in IT at the North-West University consists of coursework (8 semester modules) and a project module. A few years ago government prescription demanded changes to the project module. These changes included a higher number of credits as well as changing the nature of the project to have research oriented content [1]. Currently the number of credits is 32, which implies roughly 320 h of work for a student during an academic year [2].

Recently our institution started a process to get accreditation for the IT program from a professional computer society. In order to align with their requirements another set of demands also surfaced for the project module. One of the main requirements is that the project module must also produce an artefact during the process and not only be a research project. Another demand is the inclusion of legal, social, ethical and professional issues (LSEPI) into the program [3]. With the increased emphasis on ethical issues within organisations as well as government and academic environments this paper explores the topic of ethics and how it is handled in the IT honours project module. The research question for this study of the project module content was: "*How aware are students of ethical and related issues when doing their project?*"

When reviewing current literature on this topic a leading local university's project module documents were analysed. They indicate a twofold process to obtain permission for a project to progress. A form is completed by the student to get permission to use other students as sources of information (access to students for the purpose of research). The supervisors' details as well as the research proposal are included in this form. This form goes to the director of student affairs. Another form that is needed is the ethical clearance which is submitted to the faculty's ethics committee [4]. Aspects that are covered include:

- Has the student read the university's code where human subjects are involved.
- Is the student familiar with the procedure of collecting data.
- Has enough information been given to the participants.
- Informed consent.
- Permission to conduct the research where student are involved.
- Has anonymity and confidentiality been offered to participants.
- Issues regarding harm to participants or to the university.
- Any other ethical issues.
- Can this project lead to publication and subsequent issues regarding authorship.

Feedback on this process is usually given within a short time in order for the student to make amendments and continue with the project.

From the previous discussion it can be seen that students from this university are guided through the process to reflect on ethical issues and to obtain ethical clearance for their projects.

This paper will focus on the university where the project module has recently been changed and will demonstrate how ethics and related topics such as professionalism and social issues are handled within the project module. The layout of this paper is as follows. The research method will be discussed in Sect. 2. Section 3 presents a discussion of how this project module was managed and executed over the past number of years. Example projects will be discussed in Sect. 4. Thereafter it will be shown how the LSEP issues are incorporated into the module by doing a narrative analysis of each project. The focus in Sect. 5 is on the ethical issues that the students have to identify and reflect on. Section 6 concludes this paper with a summary and possible future work.

2   Research Approach

The main approach to make sense of the project module was to analyse each project in terms of certain factors such as key words used, having a definite Information security content or not, ethical dilemmas identified and reflection of the student and supervisor on the product and process. This paper, however, only focuses on the ethical content to align with the aims and scope of WISE.

The main source of data was the project documentation of the students, e.g. project proposals and projects reports. The proposals and reports were qualitative in nature. Therefore an approach of analysis of data was required to explore the content of the relevant parts, presenting the findings and interpreting it in a way that makes sense of

the results. An in depth analysis of what was said and communicated by the students was necessary; therefore narrative analysis was the appropriate approach. Narrative analysis refers to a wide variety of approaches within many disciplines and sub disciplines where interviews and qualitative data are concerned. According to Wood and Kroger [5] the aim is to get a deeper understanding of the phenomenon under investigation. However, there is more than one way of doing this. Each project has its own questions and aims and therefore the researcher has multiple ways to do narrative analysis and interpretation [6]. In this context the reports of the students are the vessels in which content is held [7]. Different topics were examined, retrieved and categorized in order to get a deeper understanding of the ethical issues involved in these honours projects. The yes/no answers in the questionnaires were counted and are shown and discussed in Sect. 5. The students were required to elaborate on these answers and these qualitative data in the reports were analysed using a narrative approach. Short interviews with the lecturers who acted as project supervisors were also conducted and their input to the students on ethical issues will also be presented in Sect. 5 along with the students' reflections on these matters.

The following section presents the management of the project module including some of the internal and external requirements.

3 Project Module Management

The number of students in the IT honours program is between 30 and 40. Around 9 lecturers have to supervise these projects. Normally the lecturers propose project topics, however sometimes students also suggest topics that have to be in line with the necessary requirements. Previously the honours projects that were done by students differed in content and nature. Some students developed a practical system while other projects had a bigger research component. Since 2011 the government prescription that the project must be a research project changed the way in which students and lecturers approached the project [8]. Until 2013 the project module was not fixed in nature and it was difficult to get uniformity with the evaluation of the projects.

In 2014 the nature of the project was changed yet again due to the prescription of being a research project as well as producing an artefact [3]. The process of managing and supervising the project can be summarized as follows [2, 8]:

- The students are given a project module study-guide in which the aim and significance of the project is presented. The manner in which the project is managed is also described, the role of the project supervisors is discussed and teaching, learning strategies and assessment issues are presented. There are guidelines as well as marking schemes for each component of the project.
- The students are also referred to the guidelines of the university regarding postgraduate studies, writing reports and referencing.
- The aim of this module is highlighted to the students as [8]:
  - To enable students to do research, collect and analyse data and write a well-structured report and article of the results, as well as to communicate the research results during a presentation.

- To enable students to apply knowledge of various other modules in the development of an artefact and associated documentation.
- The time duration of the project is from February to October.
- Project assignments: Students are given a choice of topics proposed by the lecturers.
- The role of the lecturer is to supervise the process and give guidance. Weekly consultations are normally held.
- An electronic platform is used for the dissemination of information and documents as well as for the submission of completed components of the project.
- Some of the lecturers also inform students of various aspects of the module e.g. research methods, system development strategies, writing of articles, etc. There is also a project coordinator that oversees these topics.
- Some projects can be done in small groups but each student must individually submit a final report.
- Assessment is done on five components:
  - Project proposal and planning
  - Literature study
  - Artefact, poster and documentation
  - Full report and article
  - Presentation.

  For each of these components, dates for completion are given at the beginning of the year. Guidelines and marking sheets are available for each of the components. Both the supervisor as well as a moderator assesses each component of the project. All the lecturers assess the presentations. The students also do a peer-assessment of their fellow students' presentations.
- The aspect of ethical, social and legal issues also gets attention. Students are required to do a literature review on ethical issues. As a starting point they are referred to relevant chapters in research methods textbooks. They also have to complete a questionnaire on the relevance of ethical, social and legal issues regarding their own project. In these questionnaires the students have to indicate how they will address these issues in their projects. The questionnaires are included in the project proposal as well as the final report.

  Many textbooks specifically aimed at postgraduate students in IT inform students about ethics in the research process [6, 9]. Olivier [9] for instance discusses examples of unethical situations in the research milieu and in so doing provides the students with insight of what to be cautious about. The practice of having an ethics committee or review board to evaluate research proposals and ethical clearances is also explained. Another textbook prescribed to the honours projects is Oates [6]. Issues that are highlighted in [6] are:
  - The rights of participants in a study: e.g. right to withdraw, right to anonymity.
  - The law and research: e.g. data protection, legal liability when software is developed.
  - Responsibilities of the researcher: e.g. behave with integrity.

    LSEP aspects are also discussed throughout the students' curriculum at different year levels in modules such as programming, system analysis and design, databases, new developments etc. Definitions or broad descriptions of ethics are

discussed. An example of a definition of ethics that is used is "*A set of principles that guides decision making based on personal values of what is considered right or wrong*" [10].

- The University has a policy on plagiarism. Students must adhere to these guidelines.
- As part of the final project report the students have to reflect on what they have learnt while completing this project.

As can be seen in the above list ample help was provided to the students regarding time and process management. Regarding ethical issues an effort was made to inform students about ethical and related issues though lectures, references and examples.

The following section describes a few of the projects that were completed during the previous year(s) indicating the variety of project topics.

4   Project Examples

Students can choose from a range of topics for possible projects offered to them at the beginning of the year. These proposals come from the lecturers that have to take on honours projects. These topics originate from their own fields of interest or expertise or research areas. The students select 5 topics in order of their preferences. A committee allocates a topic to each student in such a manner as to assign them, as far as possible, one of their top 3 choices in order for them to be positive towards their topic from the start of their project.

Examples of project topics, with aims or descriptions as well as an indication of possible ethical issues, are [8]:

1. Generating secure passwords through the use of a password generator:
   "The goal of this project is to create a password generator that will help users to protect their data and files from unauthorized access and theft, as well as creating a secure "password vault" that will be used to store the generated passwords so that the users do not need to remember all of them. In order to achieve this, the following objectives must be met:
   – Investigate existing methods for safe storage of passwords.
   – Conduct a survey to access individuals' awareness on password management.
   – Develop an application for individuals to securely store their passwords."
   Analysis: Yes - noticeable ethical issues.
2. Automated Computer Trading System Using Price Action To Predict Currency Movements.
   Analysis: Perhaps – not so obvious to detect ethical issues.
3. Investigation of privacy concerns regarding mobile positioning data:
   "The aim of this project is to investigate privacy concerns of mobile positioning technology. In order to accomplish this, the following objectives need to be reached:
   – Assessment of the privacy issues of mobile positioning technology.
   – Evaluation of privacy awareness of mobile users.

- Develop an application to monitor access to the mobile user's location, in order to improve user's awareness and understanding of their mobile applications usage of their location data.
- Evaluate the usefulness of the application."
  Analysis: Yes - noticeable ethical issues.
4. How the programs of the NSA are harming the integrity of the Internet:
   Aims:
   - "To critically evaluate the activities of the NSA and how they harm the integrity of the Internet.
   - To inform the public about mass surveillance and what they can do to stop it and how they can protect themselves from it.
   - To identify and critically evaluate the ethical implications of mass surveillance by referring to surveillance and abuse of powers in other countries where mass surveillance is done."
   Analysis: Yes - noticeable ethical issues.
5. The development of an android mobile electronic banking application for elderly people:
   "The aim of this project is to do thorough research regarding the specific needs of elderly people, and to develop a mobile banking application that will satisfy this target group's needs, if they want to make use of electronic banking services.
   Analysis: Yes - noticeable ethical issues.
6. Social engineering: Why the social engineer succeeds?
   "Social engineering will be studied as an attack on individuals and organizations to get sensitive or private information. The aim is to analyse and inspect different aspects of a social engineering attack and finally summarize how these different elements contribute to the success of social engineering attacks."
   Analysis: Yes - noticeable ethical issues.
7. A group project on game development. Each member in the group did research on a specific aspect of the gaming industry, for example, graphics and software development methodologies. Furthermore, a game was designed and developed by the group as a whole.
   Analysis: No – not so obvious to detect ethical issues.

These examples indicate the variety of topics and different fields of interest of supervisors and students. Some project topics have obvious ethical issues while with others such issues only become apparent at later stages.

The next section presents the analysis of the contents of the projects regarding the ethical questionnaire that the students have to complete as part of their project planning as well as their own reflections of these issues.

5   Analysis and Discussion of Ethical Content

Each student has to complete a questionnaire on ethical issues pertaining to their project topic. This questionnaire was developed from example documents, guidelines from the university and prescriptions from external bodies. 33 project reports were used

Table 1. Responses of students to ethical questionnaire

Question	Yes	No	N.A.	No answer
1. Did you read the sections on ethics?	31	0	0	2
2. Do you use people as a source of data?	14	17	0	2
3. Do you need permission.e.g. equipment?	11	20	0	2
4. Assured confidentaiality for participants?	19	6	6	2
5. Damage/harm to environment/participants?	4	26	1	2
6. Risk to institution?	2	28	0	3
7. Any other ethical issues?	7	23	0	3

as data and analysed. The questions that were asked in the questionnaire, which they had to reflect upon and get more information on, are listed in Table 1.

1. In general all the students indicated that they read the sections on ethics in research in the prescribed documents and textbooks. Two students did not include their ethics questionnaire in their proposal or report. (Thus they did not adhere to the mark sheet and requirements of the layout of the required documents). One of these students, however, did include a discussion of the ethical issues of his project in his ethical literature study.
2. 42 % of students conducted a survey or used people as a source of data. It was then compulsory to assure the respondents that their data will be used in a confidential way and their privacy will be protected. This was done as can be seen in the fourth question where 19 of the 33 students gave the assurance of confidentiality to their respondents.
3. 11 Students needed special equipment and had to make arrangements for equipment such as Raspberry Pi boards, Apple computers, Lego Mindstorm sets, etc. They had to make sure that they used the equipment in an orderly and secure manner.
4. Further investigation was done into the apparent discrepancy between questions 2 and 4. Although 42 % said people are used as data sources and 57.6 % indicated confidentiality to data, 18.2 % indicated that they did not have to assure confidentially and 18.2 % said the question is not applicable. Strictly speaking, these 17 students that said no in question 2 should also have said no in question 4. It seems that there can be confusion of what is applicable or not when people are used as a source of data. This needs to be clarified to students in future.
5. 78.8 % of students indicated that no harm could be done to people or the environment when conducting the project. The 4 students that answered yes to this question had to take due care not to let this principle slip. This question relates directly to the content of the code of ethics/conduct of the ACM and BCS [11, 12].
6. 28 students indicated that there would not be any harm to the university while conducting their research project. The 2 yes answers concerned the use of university equipment and software licensing.
7. 21 % of student answered yes when asked if there are any other ethical issues regarding their project. These include aspects such as privacy issues in location based applications, moral and psychological implications when developing games,

face recognition in home automation applications, commercialization of artefacts e.g. intellectual property rights, etc. They had to discuss this with their supervisors and write a section in their report on how this will be handled. Almost 70 % of students did not have any such issues or could not think of any.

Figure 1 presents the seven questions and the responses of the students in a bar graph. It can be seen that the last 3 questions have the most "NO" answers. This may indicate that the ethical concerns relating to people, the environment and the university is minimal. It is not zero, therefore, these issues must definitely be reflected upon and ethical awareness of students is thus necessary.

The students had to expand on the ethical and legal issues that applied to their projects. The following indicates some of these reflections:

- Quite a few mobile applications were developed. With this the aspect of location data had to be taken into account as a possible privacy violation.
- New technology was used. Permission was needed for its use and due care had to be taken while using the hardware.
- The issue of proper licensing of software was also a point to consider. The alternative of using open source software was also suggested.
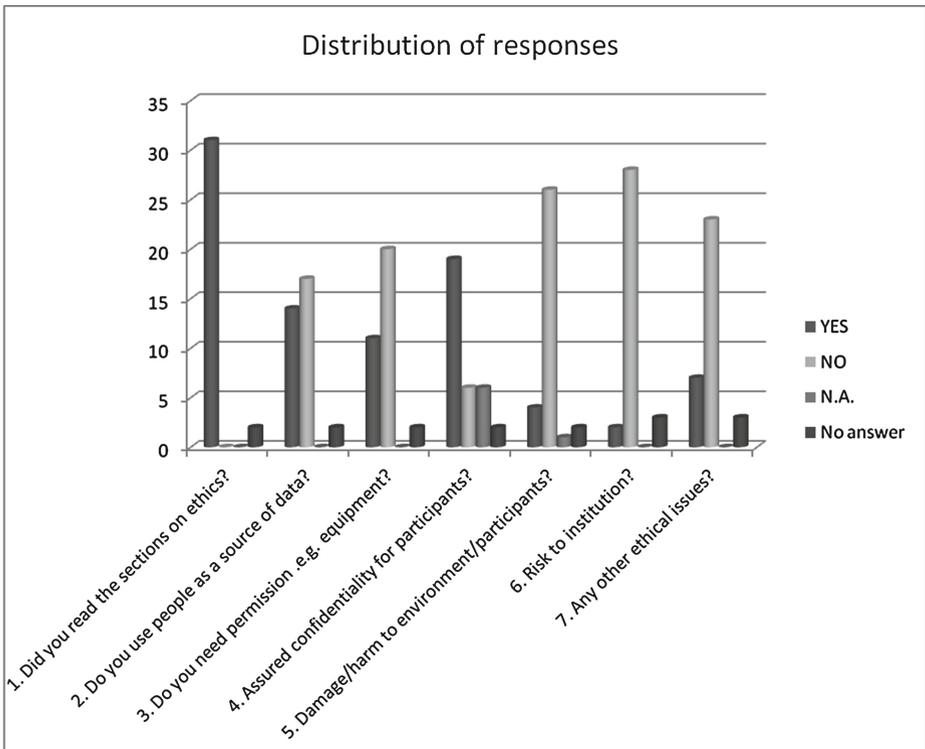

Fig. 1. Distribution of students' responses to ethical questionnaire

- When surveys were done, due care had to be taken to ensure confidentiality of data and identity. Respondents gave informed consent and had the option to withdraw from the study if they wanted to do so.
- In the games project violence was highlighted as a possible moral or ethical issue and age restriction was proposed as a solution. One of the game project students also included a chapter on ethical issues in her final report.
- One project was on the possible damaging effects of mass surveillance. The need of making users aware of these types of actions was highlighted in this project.

The above points demonstrate that students did indeed reflect on social, legal and ethical issues. Table 1 and Fig. 1 indicate in how many of the projects these aspects are present.

After interviewing the supervisors and moderators the following aspects came forth:

- Time management is a huge problem! Although deadlines were given, it was postponed with regularity resulting in a chain effect of accumulation of work.
- Students need to have adequate prerequisite knowledge.
- They need to be enthusiastic about the topic of their project.
- The moderators were mostly satisfied with the process where they assessed different components of different projects.

After the analysis of the interviews with supervisors as well as the students' project documentation a concern that emerged was that the supervisors did not reflect deeply on the ethical aspects and they were easily satisfied that the students did it adequately. Another concern was that not all questions were answered. This should not be allowed.

The university under discussion has a very lengthy application document and process for obtaining ethical clearance for research projects. Therefore an abbreviated document was created for this project module. It is recommended that in future the process for obtaining ethical clearance for honours projects be reconsidered and shortened.

Legal, social, ethical and professional aspects within IT are important and students must be equipped to identify these issues and reflect on how to handle this. The way the ethical questionnaires were filled in and discussed indicates that more guidance is necessary from the supervisors.

The research question that was posed in Sect. 1 was investigated by analysing the narrative content of the students' project documentation. From this analysis it is seen that the students have an adequate sense of ethical and related issues and can approach their work in an ethically responsible manner. However continuous exposure to the importance of LSEP issues remains a challenge in the IT curriculum.

The following section concludes this paper with a summary and some final thoughts.

6 Conclusion

This paper presented a reflection of the handling of the project module for the IT honours program. The manner in which the project module is currently being managed under internal academic demands, external demands from government as well as accreditation requirements was discussed.

Examples of projects were presented (some with specific Information Security content) indicating the increasing importance of the topic of security awareness and expertise of students completing their studies in IT. It is shown how ethical, legal and social issues are included in the project. Lessons learnt from the process are shared in this paper.

Key aspects that came forth from this study include:

– Deeper reflection is needed on ethical aspects by both the students as well as the supervisors. Not all ethical issues are obvious at the beginning of the project;
– Proper completing of the questionnaire;
– Streamlining the ethical clearance process for the project module;
– Continual effort to raise the awareness of these important matters.

For future work reflection of the project process and product is needed and external bodies' input must be evaluated and incorporated into the management of the project module. IT students' awareness, expertise and knowledge regarding ethical issues need to be relevant and processes followed must be adaptable for current and future demands of the industry and related professional IT bodies.

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