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Authors:
Mary Panko and Niranjana Singh

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Undergraduate Research: A Source For Faculty Publications?

Mary Panko, Niranjan Singh

Dept. of Transport Technology, Unitec Institute of Technology, Auckland, New Zealand

Email address:

mpanko@unitec.ac.nz, nsingh@unitec.ac.nz

Abstract: Over the last two decades undergraduate students have been encouraged to problem solve in 'the real world' in order to construct their own subject knowledge. This generally means that students are required to carry out research in their disciplines, a process which inevitably leads to the production of quantities of data. Once their findings are reported back to faculty and have been graded, they are largely ignored, as they are 'only' the product of undergraduate research. However, since 2000 there has been a move to bring this type of work into the open through undergraduate research conferences in order to benefit both the students and their institutions. Nevertheless, except for a few publications within medical teaching, faculty themselves have not widely used this data for their own research, perhaps fearing its potential lack of authenticity or credibility. This paper explores a case study to examine the validity and reliability of students' findings and considers whether the observations obtained by students can or should be made into academic publications by staff. This study comprised four cohorts, totaling 109 second-year undergraduate automotive students, who had made repeat visits to a number of automotive workshops and reviewed the workshops' activities with a particular focus on customer service, health and safety, and waste management. Analysis of the top 25% of students' reports revealed that a number of compliance failures were appearing on such a regular basis that these findings should be brought to the attention of the automotive industry. The paper concludes with a recommendation that under carefully controlled conditions, academics should draw on this hitherto ignored seam of research data.

Keywords: Undergraduate Research; Ethics, Validity and Reliability

1. Introduction

The concept of academic staff (or faculty in North America) using student gathered research data as a tool for their own research publications is not a new one. The findings of postgraduate students at both Masters and doctorate level has long been a mainstay in the production of research outputs and may often constitute the bulk of the material that staff rely upon for maintaining the level of publications required by their institutions. The ethics of this practice is normally recognized from the outset, is generally addressed by providing the names of both staff and student as co-authors and can be of undoubted benefit to both parties.

What is far less common is the use of acknowledged undergraduate data in research publications by staff. An Internet search reveals that a limited number of examples of this practice can be found - mainly in the health and medical education sectors, where undergraduates are sometimes invited to participate in collaborative projects. An example of this can be found at the University of Michigan Medical School (2013) where selected students may be offered the opportunity to research in a collaboratively mentored fashion with the research staff of the Biomedical Sciences Program.

Where such research has resulted in a joint faculty/student publication which has been reviewed by another member of academic staff and then published in an undergraduate journal, the interesting issue emerges: should such a publication count toward faculty promotion and tenure? This complication may be covered by rules within an institution but need to be explored before misunderstandings arise. Indeed, the matter of prior negotiations to reach agreement is one which is ignored at its peril at any level of collaborative research.

However, the major transformation that has occurred in undergraduate education over the last twenty years is institutional encouragement to students to become active researchers in their own right. Healey and Jenkins (2009) extended the work done initially in the United States and argue that current university education curricula need to be:

- Research-led: learning about current research in the discipline;
- Research orientated: developing research skills and techniques;
- Research tutored: engaging in research discussions; and,
- Research based: undertaking research and inquiry.

In North America this latter point has led to the establishment of undergraduate research conferences and associated published proceedings (Butler & Lupton, 2012) so that students gain experience and publishing opportunities at an early stage in their career. This involvement in research not only may enhance their future careers but also serves to motivate students to remain and succeed at university. Furthermore, according to Lopatto (2010) this engagement is positively compatible with gains across the entire academic spectrum. Recent studies (Butler, 2012) have revealed that the number of extant student research journals, mainly linked to prior conference proceedings, has increased by approximately 10% per annum between 1985 and 2012 with currently 69% being based in America, 20% in the UK and the remainder from other European countries.

It has therefore become clear that the value of student research is becoming increasingly recognized at tertiary level. This leads to the question central to this paper – whether there are situations where staff should be able to acquire and then analyze student findings and publish their results under their own name. The answer to this appears to depend on three main issues: ethics, validity and reliability.

2. The Underlying Issues

2.1. The Ethical Issue

There are several aspects to this dimension. Firstly, there is the ethical practice within the conduct of the research itself and the extent to which the student is aware of the care which he or she has to adhere to all the agreed ethical constraints while they undertake their investigations. In a qualitative study this covers all the well-known issues connected with anonymity and informed consent required when working with participants. The need for a supervisor or mentor to be rigorous and stress the importance of ethical behaviour cannot be over-emphasized as it is easy for an inexperienced student to acquire information in any way

possible, in order for them to complete that part of their studies. Unless the data gathered by the students met all the predetermined conditions, then it is clear that any information obtained should have no place in later research.

Overall, Table 2 indicates that the research was authentic and the reports written by the students drew attention to a range of issues they believed were relevant to legal compliance. While it must be acknowledged that significant issues might have been overlooked or incorrectly interpreted but that it appears that the reports were still fundamentally trustworthy.

Secondly, there is the aspect of whether a staff member is ethically entitled to appropriate students' work and publish it under their own name, as described in the case study in this paper. In this particular case the large group of students, who provided the original data as part of an assessed course, were not informed that their findings might be transformed into a research output and it could be argued that the automotive workshop technicians who were observed also did not know that this might happen.

Lastly, the ethical situation will vary according to whether a single student's work is being considered or whether the staff member is mining the product of many students' data, as in the quoted case study. Each of these questions will be looked at in more detail in a later section of this paper where the case study is considered in detail and any lessons drawn will be highlighted in the conclusions.

2.2. Validity

The post-positivist indicator of validity, applicable in qualitative research, is whether the findings are 'authentic' (O'Leary, 2004) while still recognising that multiple truths may also exist. This use of the term is less concerned with 'correctness' of methods, approaches and techniques but rather, was the method used 'true' to the experience. "Validity indicates that the conclusions you have drawn are trustworthy" (p.61).

This is also related to the concept of 'external validity' where conditions are not controlled as they would be in a laboratory situation. While this idea seems to introduce an element of variability or even erraticism, it does allow transferability to occur between one set of research findings and another. This interpretation of validity will be applied to the case study and a validity checklist, outlined by Seliger and Shohamy (1989. p.95) for structured observational research, will be used to examine the validity of the student research. The seven key factors highlighted by these two authors are:

- Population characteristics (subjects);
- Interaction of subject selection and research;
- Descriptive explicitness of the independent variable;
- The effect of the research environment;
- Researcher or experimenter effects;
- Data collection methodology;
- The effect of time.

2.3 Reliability

The classic determinant of reliability is whether the research is repeatable and will produce consistent results. These criteria are based on standardisation of procedures which, although appearing logical, raise the counter-interpretation posed by Flick (2012, p. 207):

...how far these criteria, with their strong emphasis on standardization of procedures and the exclusion of communicative influences by the research, can do justice to qualitative research and its procedures, which are mainly based on communication, interaction and the researcher's subjective interpretations. Often these biases are seen not as biases but as strengths or even preconditions of the research.

In the following case study, both consistency and interpretation will be considered as elements of the reliability of the students' research.

3. Results and Discussion

The data on which this paper is based stems from two contrasting case studies, both from the field of automotive technology. The first consisted of a large group of second-year students whose reports were selectively examined from four cohorts, in order to find the most reliable examples (see Case Study One). The second focused on the report of a single, final year student, whose work mirrored the findings of an academic staff member and who was familiar with the situation described in the student's final report (see Case Study Two).

3.1. Case Study One

The research process in this instance was undertaken by four cohorts of second year undergraduate students studying a semester-long course designed to deepen their understanding of professional practice within the automotive industry. During the five weeks while pairs of students visited workshops, observing and recording operational procedures and occasionally asking questions of workshop personnel, they relayed their progress back to their supervisors on a weekly basis. At the end of this time, as part of their assessment requirements for this course, students were required to produce reports, based on their joint research, which was worth 35% of their overall course grade. Once that final report was written, students were interviewed singly by their supervisor to determine the extent of their individual participation in the joint inquiries and the understanding possessed by each of the individuals. Their summative grade for this report was potentially modified by information arising from this interview.

In the later analysis of the students' findings by the academic staff member, all of the reports were examined from a total of 109 students but only those whose report scored 30 out of 35 (i.e. 86% or above) were ultimately used to consider issues of documented workshop compliance. This process was designed to eliminate the weaker students whose results might have been less reliable. This had the effect that although pairs of students prepared each report, as the final grading process could increase or reduce their individual results; the work of some lower-performing students within a pair was not taken into account.

In the final analysis 26 out of 109 of reports were examined as indicated in Table 1.

Before the students formed themselves into pairs they had three collective sessions with their supervisor who initially reminded the students about the details of the main regulatory areas they needed to take into account when observing workshop practice.

Table 1: Source of student reports

Semester	Overall Number of students	Overall number of reports examined
1 - 2011	22 (11 pairs)	1
2 - 2011	25 (12 pairs)	10
1- 2012	29 (14 pairs +1)	8
2 - 2012	33 (16 pairs +1)	7

These were: Health and Safety Legislation, Waste Management, Customer Care and Workshop Practices. These issues brought together legal requirements, published in relevant New Zealand government Acts, which the students were recommended to examine with reference to its theory, main principles and base their observations on these key issues.

In addition to emphasizing the nature of observations they would be making, the supervisor also detailed the ethical procedures they would need to comply with, including verifying the preparation of information sheets and consent forms by the students themselves. In relation to this, he stressed that they were not to inquire about economic aspects of the businesses they visited, and not to report on it if they did incidentally receive information about workshops' financial aspects. Lastly, he instructed the students not to select workshops where they might have been employed in the past, in order to reduce bias or conflict of interests.

At the end of this introductory stage the students formed themselves into pairs and made contact with garages in the areas where they could access conveniently. Four types of automotive businesses were selected by the students and from those finally selected for analysis the types were: twenty general automotive service centers; four Paint and Panel beating workshops, one Tire replacement workshop and one Warrant of Fitness Centre. This range ensured that diverse aspects of compliance became highlighted in the different sites. In most cases both students visited the same premises either singly or with one another to make their observations but in one case, the team decided to compare practices and visited two businesses and wrote their report combining their findings.

The staff member's meta-analysis ultimately became focused on issues of legal non-compliance as the observations made by many of the students suggested that a range of activities of outstanding danger to both the public and to workshop personnel were taking place across a number of locations. Furthermore, he was so perturbed by these findings that he believed it was essential that these results be publicized to audiences who had an overview of automotive practices, such as the New Zealand Motor Trade Association (MTA) and the New Zealand Motor Industry Training Organisation (MITO).

3.2 Results

A brief summary of the major non-compliance issues (to be described in more detail in a forthcoming publication) indicated that issues like poor ventilation, particularly in Paint and Panel beating workshops, was the major hazard for employees, followed by a general lack of personal protective equipment and that poor waste management procedures were occurring at six of the service centres. Of more immediate impact to the general public were the three instances where customers were permitted to wander around in potentially dangerous areas.

This condensed account does not show the large list of positive compliance features or the high degree of customer care observed in the majority of the workshops visited by students.

3.3 Ethics, validity and reliability

In general, the internal research ethics were adhered to by the students except that several did visit workshops where they had some form of previous relationship with the staff. Perhaps this is not a surprising finding although the results noted by the students do not appear to have been affected by this situation - the comments across the range of students indicating similar proportions of positive and negative factors, whether or not they were known at a particular workshop. If this were considered to be a more important issue, it is possible that a stronger warning be given in advance, and this factor could be included on the ethics documentation to be signed by the workshop representative.

The most significant ethical dereliction in this case study was that neither the students nor the workshop personnel were warned in advance that these observations might become part of a later publication. This was due to an initial failure to recognize that further research might be drawn from the data gathered by the students. The question must therefore be addressed: what difference might this have made and would they have declined to take part if they had known?

It would appear that the ethical principles indicated in the original documentation remain adhered to in principle. In other words, consent to taking part in the data gathering was obtained at the outset, and that critically, anonymity of businesses and personnel was maintained. On a more positive note, in the instance quoted in this case study, it would seem that the ethics of acting in the best interests of the public and workforce employees outweighed any reservations that might be apparent in the conduct of the original research. Turning towards the issue of validity, as stated previously, this is reviewed using the criteria outlined by Seliger and Shohamy [7] (p. 95) which are considered as relevant to the researchers (the students) and in relation to the workshops researched upon by the students as both are the subjects of this study. The key findings are listed in Table 2.

Table 2: Research validity in relation to researchers and workshops

Criteria	Students	Workshops
Population characteristics (subjects)	Students in undergraduate program	Range of different types (General garages, paint shops etc.)
Interaction of subject selection and research	High achieving students Selected from 109 potential individuals	Might have relationship with workshop
Descriptive explicitness of the independent variable	Particular legislation identified by lecturer	Wide range of legislative issues possibly relevant
The effect of the research environment	Students focused on range of features	Different workshops provided a range of diverse non-compliance issues
Researcher or experimenter effects	Students do not intimidate garage personnel	Workshop personnel could request students not to identify non-compliant procedures
Data collection methodology	Procedures determined by supervisor	Observations and a few interviews
The effect of time.	Similar students in each of the 4 cohorts	2 workshops visited in consecutive semesters

Overall, Table 2 indicates that the research was authentic and the reports written by the students drew attention to a range of issues they believed were relevant to legal compliance. While it must be acknowledged that significant issues might have been overlooked or incorrectly interpreted but that it appears that the reports were still fundamentally trustworthy.

This is supported by the consistency of the findings which falls into the area of reliability. These students, the majority of whom who had previously been exposed to garage practices for several years before reaching this level of an undergraduate program, all went to observe listed characteristics and report back on their findings. Most addressed all the items required by the course (Health and Safety Legislation, Waste Management, Customer Care and Workshop Practices) either in a positive or a negative manner. Furthermore, the pairs of students, working independently from other teams, displayed consistency across the data that they gathered and provided examples of problems they identified, frequently in the form of photographs taken at the organisation, taken with the permission of workshop management.

3.4 Case Study Two

This study investigated the curriculum, delivery and subsequent qualifications of an Automotive training programme currently being taught at a government tertiary institute on one of the main Pacific Islands. The student who researched the topic had previously been a member of the teaching staff at that institution before coming to New Zealand to study for a degree. As a result of his findings, academic staff in New Zealand are now in the process of collaborating with the Pacific institute to bring about the transformations his report recommended.

The student started his research from the premise that teaching a level-2 certificate course over a four-year timeframe, with interspersed lengthy periods working in workshops for low rates of pay, was unlikely to be conducive to encouraging participants to enroll, or, having enrolled, remain for the duration of the entire programme. Furthermore, this qualification was not recognised internationally. His final report made three main recommendations:

- (1) The need to change the duration of the programme from four to three years,
- (2) Participants would graduate with a level-4 Diploma, and
- (3) This Diploma would be internationally recognised.

He also recommended that a new programme should not be an overseas import, but one tailored to the needs of the Pacific Islands and developed in conjunction with teachers based on the Island.

Unknown initially to the student, a New Zealand Automotive academic had carried out a similar investigation two years earlier at a neighbouring institution and had come to identical conclusions. This additional unpublished study helped to substantiate the validity and reliability of the student's conclusions.

Working closely with a supervisor, the student gathered documentary data concerning success and retention figures as well as information about the existing course structure. He also conducted stakeholder interviews on the Island with representatives of the government institution, involving both senior staff and course lecturers, as well as students and garage managers, to discover their views on proposed programme changes. His findings revealed conclusively that such a change would be a popular move. However, he also discovered that one main impediment to this transformation was the low qualification levels of current teaching staff. In other words, they were not currently eligible to design or teach programmes at level 4.

The outcome of his research has developed into an on-going project with another academic and has become a major impetus in the construction of a collaborative enterprise between the New Zealand tertiary institution and the one in the Pacific.

4. Conclusions and Implications

Student research is now internationally seen as playing an essential part in the development of a well-rounded graduate and increasing opportunities are now created to enable the outcomes of this process to become widely disseminated. But the question posed initially was to what extent may the findings of these students, particularly where they result from the work of many participants become available for academic staff to use as a source of their own data? This paper has argued that under carefully controlled conditions this should be an appropriate step. Furthermore, it may be the only way that individual elements of data can be drawn together and published, as this overview is not often available to the students who performed the research.

The first key implication from this conclusion is that if this process is to be legitimized it is important that it is made transparent from the outset so that both the students and any people they may involve can be aware of this potential result. A general statement to this effect could be introduced at the start of any course in which the student body is likely to be carrying out investigations. Bringing this caveat to the attention of the participants would not only be an ethical step but would also enable students to recognize the importance of their role in the research process and should be a motivating factor.

A second implication is that the undergraduate students need to keep in close contact with their supervisor during the research process, being monitored for process and authenticity. This practice is basically a transplantation of the postgraduate supervision system but as it is likely to involve larger numbers of students it is possible that this could be smartly managed through group sessions, where students would also gain the advantage of learning from their peers.

Finally, as demonstrated in the case studies outlined in this paper, there are times when it is in the public good for academics to highlight the findings of their undergraduate researchers and not to do so could be considered to be a dereliction of a duty of care. The other underlying issues that flow from this paper are (a) the reinforcement of the place of research in undergraduate curriculum, and (b) issues of supervision and mentoring of undergraduate research.

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