Evaluation of a Generic Assessment Scheme for Pharmacy Undergraduate Projects

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Every year, the completion of research projects is becoming more critical in the final year of UK M. Pharm programmes. But as this practice becomes more general, it is also becoming increasingly difficult to devise a set of assessment criteria that measure equivalence in student performance through both a disparate range of research disciplines and detached methods of evaluation. This study entertains a reform of these current assessment methods by employing new, generic evaluation criteria through which students undertaking projects in different disciplines may nevertheless achieve equality of marking. After explaining the application of these proposed criteria and measuring their fairness and precision though parametric statistics, it is concluded that such an assessment scheme provides a uniform, accurate and fair system for assessing final-year research projects across a wide spectrum of disciplines.

Keywords: Assessment; Research projects; Pharmaceutical Society; M. Pharm

INTRODUCTION

Research projects are an integral part of the final year curriculum for UK honours degrees in pharmacy, as determined by the accreditation criteria of the Royal Pharmaceutical Society of Great Britain (RPSGB) (Royal Pharmaceutical Society, 2002). In 1997 all UK schools of pharmacy, in accord with the Education Division of the RPSGB, changed their undergraduate pharmacy degree courses from a three years (four years in Scotland) bachelors degree to a four year Master of Pharmacy (M. Pharm) degree, in line with European Union directives (European Communities Council Directive, 1985). The governing body for higher education in the UK, the Higher Education Funding Council (HEFC), has recently determined that the final year of four-year first degree masters courses should be taught in accordance with the criteria for Masters level degrees (Credit and HE Qualifications, 2001). Curricular material in the fourth year should, therefore, comply with the following Level Descriptor: "Display mastery of a complex and specialised area of knowledge and skills, employing advanced skills to conduct research, or advanced technical or professional activity, accepting accountability for related decision making including the use of supervision." With this emphasis on student self-directed study, research projects will, increasingly, develop as a key element to the final year of study on UK M. Pharm degrees.

The assessment of final year projects generates a number of logistical and educational problems. One such difficulty lies in the fact that, in reflecting the broad spectrum of the pharmacy curriculum, projects are undertaken in a wide range of pharmaceutical disciplines. Pharmacy research projects may, therefore, be laboratory-based, computer-based or conducted in a pharmacy practice setting. These different types of project require certain skills, such as literature review and report writing that are common to all. Other skills, such as instrumental manipulation, software development or patient consultations, are unique to particular types of project. It is, therefore, difficult to devise a set of assessment criteria that measure equivalence in student performance across these disparate disciplines. Secondly, projects are normally assessed by the student's supervisor(s) and then second marked by an independent assessor. While the supervisor

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TABLE I   Classification of research groups

Laboratory-based
  Dosage form design
  Medicinal chemistry & phytochemistry
  Pharmacology
Computer-based
  Quantitative structure–activity relationships
  Information technology & educational development
  Systematic literature review
Practice-based
  Pharmacy practice secondary care
  Pharmacy practice primary care

has first-hand knowledge of the student's input and performance in the design and execution of the project, the second marker has to base her/his judgement on the final report alone.

These problems have led the authors to re-appraise the systems in place for the assessment of undergraduate projects, with a view of ensuring equality of assessment for students, regardless of the discipline within which the project was undertaken and by whom the project was assessed.

Background to the Study

In our institution, towards the end of the third year of study, students are offered a choice of Research Groups (Table I) within which they may undertake their final year project. A time tabled session is set aside for Research Group Leaders to provide a "sales talk" on their respective Research Group after which students select their order of preference. Staff in each Research Group pre-determines, through their Research Group Leader, the number of projects that will be offered within their group. The Project Co-ordinator then allocates students to their highest choice of Research Group, based on student preference and the numbers of projects available within each group. In 2001/2002, 82% of students received their first choice Research Group $n = 134$. Research Group Leaders then allocate individual students to specific projects within their respective group.

When students begin the first semester of their fourth year, they undertake a Research Methods Module, during which they design a project plan, in discussion with their supervisor(s). This plan, which includes a literature review, aims, objectives, a hypothesis, proposed methods, a timetable for the project and key references, provides the blue print for the project. Students begin their research project at the start of the second semester. On completion of the research, students hand in their project report and deliver a seminar or poster presentation on their work.

Assessment is carried out by their Principal Supervisor, who assesses both their performance during the project as well as the quality of the report, and by an independent Second Marker whose assessment is based on the report alone. Additionally, both the Principal Supervisor and Second Marker assess the seminar or poster presentation.

Aim of the Study

The purpose of this analysis is to evaluate the effectiveness of a marking system, using generic assessment criteria which have been developed in order to achieve equality of marking between students undertaking projects in different disciplines.

METHODS

Assessment Methods

The Principal Supervisor and Second Marker are asked to assess the student independently, using their respective qualitative assessment forms. These forms set out criteria for the Principal Supervisor to assess overall performance and for the Second Marker to assess the project report (Figs. 1 and 2). Having completed their respective assessment forms the Principal Supervisor and Second Marker are required to meet to discuss their findings and to agree on a final mark for the student.

The student seminar (or poster presentation) is also jointly marked by the Principal Supervisor and Second Marker, using a set of criteria. However, this part of the assessment procedure was not the subject of this evaluation.

Evaluation of the Assessment Procedure

The aim of the evaluation was to determine the correlation between the independent assessments by the Principal Supervisor and Second Marker and between the combined independent assessments and the final agreed mark, using the 2001/2002 cohort of final year M. Pharm project students $n = 134$. This was achieved through converting the qualitative tick-box assessment forms (Figs. 1 and 2) to a quantitative format by introducing a numerical scale (1–5) for each assessment criterion, then deriving a total score from the Principal Supervisor and Second Marker, for each student.

As an approximate test of normal distribution of the data being analysed, a histogram of the agreed project report marks was created (Fig. 3).

To investigate the extent of agreement (or otherwise) between the scores allocated by the Principal Supervisor and Second Marker, the two sets of scores for each student were plotted against each other (Fig. 4) and a Pearson correlation coefficient was

Principal Supervisor's Assessment
(in discussion with the practice-based supervisor, where appropriate)

Student's Name   ....   Supervisor's Name   ....

Please tick one box in each section. The centre box indicates a normal, adequate standard

1.   How difficult were the techniques used for the project?
     Very easy   □   □   □   □   □   Very difficult

2.   To what extent did the student provide an input into the design of the project?
     None   □   □   □   □   □   A great deal

3.   How much effort did the student put into the work?
     Very little   □   □   □   □   □   Intensive

4.   How well did the student perform in the laboratory/practice?
     Incompetently   □   □   □   □   □   Research level

5.   How much help did the student receive in data collection?
     A lot   □   □   □   □   □   Virtually none

6.   How demanding was the analysis of the data?
     Very easy   □   □   □   □   □   Highly demanding

7.   To what extent has the student understood the nature of the project?
     Virtually none   □   □   □   □   □   A great deal

8.   What is the value of the research to the pharmaceutical sciences/practice/education?
     Virtually none   □   □   □   □   □   A great deal

9.   How much help did the student receive in writing up the report?
     A great deal   □   □   □   □   □   Virtually none

10. What is the quality of the written report?
     Very shallow   □   □   □   □   □   Publishable

FIGURE 1   Principal Supervisor's assessment form.

calculated. A similar exercise was carried out to investigate the relationship between the total score (Principal Supervisor + Second Marker) and the final agreed marks for each student (Fig. 5).

Additionally, the final agreed marks for the projects were subjected to an analysis of covariance checking for possible relationships with (a) the individual student's overall mark for the previous

Second Marker's Assessment
(Based on an assessment of the Project Report)

Student's Name   ....   Second Marker's Name   ....

Please tick one box in each section. The centre box indicates a normal, adequate standard

How do you rate the following aspects of the Project Report?

1.   Presentation
     Messy   □   □   □   □   □   Publishable

2.   Introduction and literature review
     Very shallow   □   □   □   □   □   In depth

3.   Would you be able to repeat the study using the methods described?
     Impossible   □   □   □   □   □   Completely

4.   Quantity of work done
     Very little   □   □   □   □   □   A great deal

5.   Quality of data
     Anecdotal   □   □   □   □   □   New & publishable

6.   Analysis of data
     Very shallow   □   □   □   □   □   In depth

7.   Discussion
     Very shallow   □   □   □   □   □   In depth

8.   Understanding of the topic
     Very little   □   □   □   □   □   Research level

9.   What is the value of the research to the pharmaceutical sciences/practice/education?
     Virtually none   □   □   □   □   □   A great deal
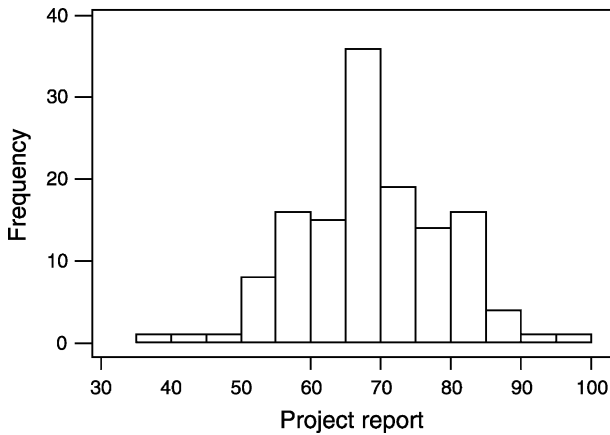
FIGURE 2   Second Marker's assessment form.

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FIGURE 3   Histogram of project report marks.

FIGURE 5   Plot of agreed project report marks (Project) versus the total of the scores for the Principal Supervisors and Second Markers (Total).

(i.e. third) year of the course and (b) the broad class of project undertaken (laboratory/computer/ practice). The intention was to check whether any of the three classes of project was being marked higher or lower than any of the others. It was not appropriate simply to compare mean marks for the three classes of project, as it was possible that students of generally higher ability might have been allocated to one type of project relative to another. By including achievement at year three, it should be a possible to control for any such bias. Furthermore, by taking account of differences in general ability, the analysis of covariance would provide a much more sensitive test for any tendency to give higher marks to one class of project. The relevant data are shown graphically in Fig. 6.

RESULTS

Figure 3 shows the histogram of the project report marks. While this is, by no means, a definitive test of distribution, the general shape of the graph excludes
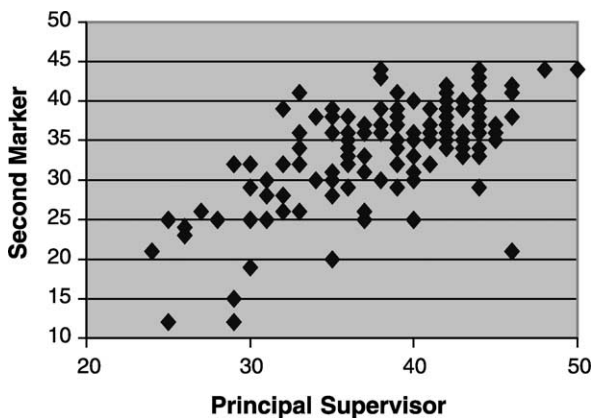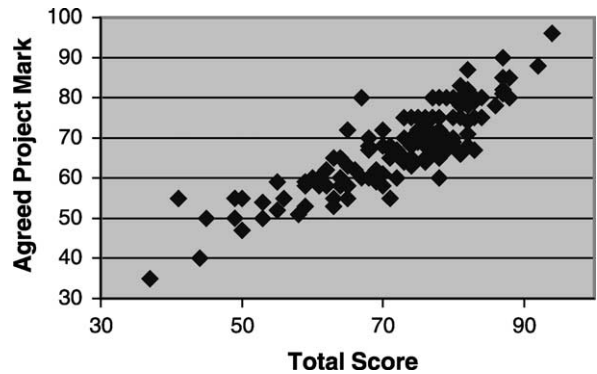
the possibility of any major divergence from normality.

Figure 4 shows a positive relationship between the scores allocated by the Principal Supervisors and Second Markers. The Pearson correlation coefficient is 0.66 supporting the impression of a close relationship. Figure 5 shows that there was an even stronger relationship between the total scores (Principal Supervisor + Second Marker) and the final agreed marks. The correlation coefficient was high (0.86).

Figure 6 shows a marked tendency for those students who achieved the highest grades during the previous year, also to achieve the highest marks for their projects. Visual inspection strongly suggests that for each of the three classes of project, the relevant symbol is scattered randomly throughout the general cluster of results. If any one of the symbols were to be concentrated along either the upper or lower edges of the cluster, this would have suggested the possibility of either over or under-generous marking, respectively. The absence of any such feature tends to suggest that all three classes of

FIGURE 4   Plot of score for Second Marker (Second) versus that for the Principal Supervisor (First).
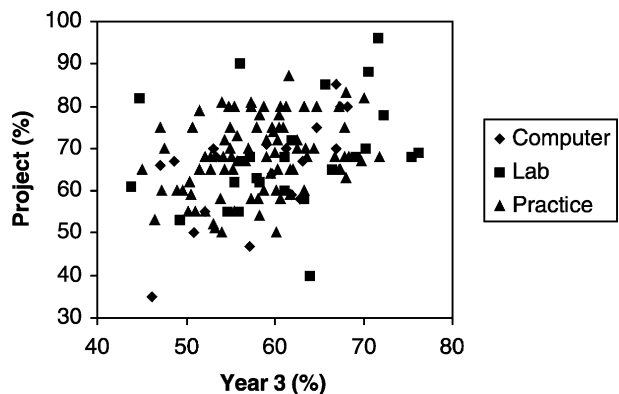

FIGURE 6   Plot of Project report mark versus overall Year 3 mark, comparing the three different classes of project.

TABLE II Analysis of covariance for project report marks, using (a) Year 3 marks and (b) Class of project undertaken as factors

Factor	F	P
Year 3 marks	19.41	<0.001
Class of project	1.09	0.341

projects were assessed in an equivalent manner. The formal analysis of covariance of this data confirmed that there was significant evidence that project marks were related to the previous year's marks but there was no evidence of differential assessment based on class of project undertaken (Table II).

DISCUSSION

The use of standard parametric statistical methods throughout this report appear perfectly justified given the distribution of the data seen in Fig. 3. The Second Marker for undergraduate projects has, normally, little information on how the student has performed in the design and execution of the project. It is, therefore, unreasonable to expect the Second Marker to assess the student on criteria other than on aspects of the final report. In this study, these criteria complemented those for the Principal Supervisor that were designed to assess performance as well as the report. Results of this study show that there was a close relationship between the independent assessments made by the Principal Supervisor and the Second Marker. The use of different, though complementary, a criterion by the two assessors appears to be justified.

The two assessors were required to use the information derived from their respective tick-box assessments forms to generate a final, agreed mark. This stage of the process appears to have worked extremely well, judging by the strong relationship between the total scores and the final agreed marks. Generic assessment criteria were developed in order to achieve comparability and consistency in marking, regardless of whether the student had undertaken a project in a laboratory, computer or practice based setting. Results of this study indicate that all three categories of project had been assessed in an equivalent manner.

CONCLUSION

Overall, it can be concluded that an assessment scheme, based on generic sets of criteria, provides an accurate and fair system for assessing projects across the wide spectrum of disciplines within which pharmacy undergraduate students undertake their final year research project.

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