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# A quality assurance procedure for pharmacy undergraduate project assessment

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**Abstract**

The aim of this study was to evaluate the effectiveness of a system for the allocation of students to final year projects and to assess the equality of marking between projects undertaken within different research disciplines. Comparison of mean project marks were assessed by analysis of variance, using analysis of covariance to take into account student academic ability based on their overall third year mark. Results showed that each research discipline was being allocated students with a similar cross-section of ability, with no statistically significant variance in either cohort. Comparing mean project marks between specific research groups, corrected by year-three performance, revealed that there were statistically significant differences between research groups in both year cohorts. Using this quality assurance procedure, the research project co-coordinator was able to identify areas of good practice and of concern, present the evidence to the respective research group leaders, ascertain the reasons for exceptional performances and to suggest remedial action where necessary.

**Keywords:** *Pharmacy, projects, assessment, quality assurance*

## Introduction

UK undergraduate pharmacy degree courses changed from 3-year Bachelor to 4-year Master of Pharmacy (MPharm) programmes, in 1997, 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), determined that the final year of a 4-year first-degree masters courses should be taught at a Masters level (Credit and HE Qualifications, 2001). Therefore, curricular material in the fourth year should meet 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 are a key element to the final year of study on UK MPharm degrees.

The allocation to and assessment of final year projects on MPharm degrees poses a number of logistical and educational problems. In particular, in reflecting the broad spectrum of the pharmacy curriculum, projects are undertaken in a wide range of disciplines. Research may be laboratory-based, computer-orientated or, increasingly, conducted in a practice setting, in line with other health-related academic disciplines (Murdoch-Eaton & Jolly, 2000; Thompson, McNeill, Sherwood & Track, 2001). These different types of project require certain generic skills such as literature review, data generation and report writing. Other skills such as instrumental manipulation, software development and techniques in social sciences may be experienced only in particular types of project. Allocation of students to particular types of project is dependent upon staffing, resources and student preference.

Assessment of projects must measure equivalence in student performance across disparate disciplines. In most higher education settings, projects are assessed by the student's supervisor(s) and by a second marker. Whilst the supervisor has first-hand knowledge of the student's input and performance in the design and

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execution of the project, the second marker has to base her/his judgment on the final report alone. In our institution, the two assessors mark the pharmacy project, independently, against sets of generic criteria, after which an agreed mark is derived. An evaluation of this scheme was recently undertaken, the results of which led to the conclusion that the scheme provided a uniform, accurate and fair system for assessing final-year research projects across a wide spectrum of disciplines (Rowe & Mottram, 2003). No matter how satisfactory a scheme may appear to be, it is important to undertake regular quality assurance evaluations to ensure consistency in the application of and outcome from the system.

The aim of this study was to evaluate the effectiveness of a system for allocation of students to projects and to assess the equality of marking of student performance between projects undertaken within different research disciplines.

## Materials and methods

This study was based on analysis of data relating to final year research project allocation and assessment for cohorts of students on the MPharm degree programme for the academic years 2002/2003 and 2003/2004. The background on how these data were generated and assessed is described below.

In our institution, towards the end of their third year of study, students are required to select their preferred choice of Research Groups within which they may undertake their final year project. Research Groups are broadly classified into three Research Areas (Table I).

Students attend a seminar session at which they receive information from the respective Research Group leaders. After this, students submit a form on which they prioritise their choice of Research Groups. The project coordinator allocates students to Research Groups based on their preferences and on the numbers of projects available within each Research Group. Research Group leaders then allocate individual students to specific projects within their respective group.

Table I. Classification of Research Areas and Research Groups.

| Research Areas | Research Groups |
|---|---|
| Laboratory-based | Dosage form design |
| | Medicinal chemistry & phytochemistry |
| | Pharmacology |
| Computer-based | Quantitative structure–activity relationships |
| | Information technology & educational development |
| Practice-based | Pharmacy practice secondary care |
| | Pharmacy practice primary care |

Evaluation was made as to whether each Research Area and each Research Group was being allocated students with a similar cross-section of ability. For each area and group, the mean mark was calculated from students' third-year performance and a one-way analysis of variance (ANOVA) conducted between areas and between groups.

On completion of the project, assessment is carried out by the student's Principal Supervisor, who assesses both their performance during the project as well as the quality of their written report, and by an independent Second Marker whose assessment is based on the report alone. It might be expected that, in general, student performance in the project module would reflect the student's general academic ability, as indicated by their most recent measure of performance, their overall third year mark. Comparability between students' third year marks and project marks was undertaken by Pearson Correlation.

Comparison of mean project marks between Research Groups was assessed by analysis of variance. In order to more accurately assess consistency in student project performance between Research Groups it is necessary to correlate individual student's project mark with their third year mark and to introduce a correction factor for this. This was achieved by an analysis of covariance taking account simultaneously of which research area or group each student belonged to and their third year mark. The analysis determines the general relationship between the students' year three marks and their eventual project mark and then adjusts each project mark downwards for a student with a high year three mark and upwards for a lower achieving student. All the marks can then be viewed as those that would hypothetically have been achieved by an "average" student. The mean mark for each group can then be compared without the bias that some groups may include generally more or less capable students.

## Results

### *Allocation of students to Research Groups*

Table II shows that most students receive their first or second choice group.

Assessment as to whether each Research Area was being allocated students with a similar cross-section of ability is shown in Table III. There was no statistically

Table II. The number (%) of students receiving their chosen Research Group.

| Student choice | 2002/2003 | 2003/2004 |
|---|---|---|
| First choice | 88 (78.5) | 67 (61.5) |
| Second choice | 21 (18.8) | 32 (29.3) |
| Third choice | 3 (2.7) | 10 (9.2) |
| Total | 112 (100) | 109 (100) |

Table III. Year-three mean percentage marks for students within each type of Research Area (number of students per area).

| Research Area | 2002/2003 | 2003/2004 |
|---|---|---|
| Computer | 59.8 (12) | 57.4 (12) |
| Laboratory | 56.9 (43) | 56.8 (33) |
| Practice | 58.8 (54) | 57.5 (63) |

significant variance in either 2002/2003 ($p = 0.397$) or in 2003/2004 ($p = 0.882$).

With regard to Research Groups, Table IV again shows a general consistency in year-three mean marks. However, in 2002/2003, QSAR students had a higher mean mark than any other group, a variance that was identified as statistically significant ($p = 0.02$). The QSAR group comprises the lowest number of students and in 2002/2003 this group included a number of high quality students. This bias was not observed in the 2003/2004 cohort of students where analysis of variance was not statistically significant ($p = 0.335$).

*Comparability of project marks between Research Groups*

Table V shows the mean marks awarded for projects for students within each Research Group.

Although there was variability, an analysis of variance showed no statistically significant difference between groups for either 2002/2003 ($p = 0.107$) or 2003/2004 ($p = 0.104$). However, as seen earlier (Table III), the mean marks for students' performance in year three were different between Research Groups. Pearson Correlation between students' third year and project marks was undertaken. For both cohorts of students a strong correlation was observed (2002/2003, correlation = 0.53 ($p < 0.001$); 2003/2004, correlation = 0.515 ($p < 0.001$)).

*Comparability of project marks corrected by third year performance*

The mean project marks for each Research Area, corrected by year-three performance, are shown in Table VI. Mean marks were similar, however, whilst the analysis of covariance showed no significant difference between areas for 2003/2004 ($p = 0.567$), a statistically significant difference was measured for 2002/2003 ($p = 0.001$).

Table IV. Year-three mean percentage marks for students within each Research Group (number of students per group).

| Research Group | 2002/2003 | 2003/2004 |
|---|---|---|
| Dosage form design (DFD) | 56.8 (18) | 57.5 (14) |
| Medicinal chemistry & phytochemistry (MCPH) | 55.6 (15) | 52.9 (11) |
| Pharmacology (PCOL) | 59.1 (10) | 60.9 (8) |
| Quantitative structure–activity relationships (QSAR) | 69.2 (5) | 56.2 (5) |
| Information technology & educational development (ITED) | 53.1 (7) | 58.3 (7) |
| Pharmacy practice secondary care (PPSC) | 58.3 (21) | 57.3 (20) |
| Pharmacy practice primary care (PPPC) | 59.1 (33) | 57.7 (43) |

Table V. Mean percentage project marks for students within each Research Group (number of students per group).

| Research Group | 2002/2003 | 2003/2004 |
|---|---|---|
| Dosage form design (DFD) | 74.0 (18) | 62.0 (14) |
| Medicinal chemistry & phytochemistry (MCPH) | 67.9 (15) | 74.4(11) |
| Pharmacology (PCOL) | 73.3 (10) | 72.5 (8) |
| Quantitative structure–activity relationships (QSAR) | 72.0 (5) | 63.8 (5) |
| Information technology & educational development (ITED) | 64.9 (7) | 67.4 (7) |
| Pharmacy practice secondary care (PPSC) | 65.6 (21) | 67.4 (20) |
| Pharmacy practice primary care (PPPC) | 66.6 (33) | 68.2 (43) |

Further analysis, comparing mean project marks corrected by year-three performance, between Research Groups (Table VII) revealed that there were, in fact, statistically significant differences between Research Groups in both year cohorts.

The difference measured between Research Areas in 2002/2003 (Table VI) was due to the DFD group that, using Tukey Simultaneous Confidence Intervals, showed the DFD group of students had been marked significantly higher than the PPPC and PPSC groups of students.

Although Table VI did not reveal a statistically significant difference between Research Areas in 2003/2004, analysis of Research Groups (Table VII) showed that, through analysis of covariance and Tukey Simultaneous Confidence Intervals, MCPH students had been marked significantly higher than DFD students. Since both these groups fall within the laboratory-based area, their mean marks had neutralised each other when analysis was performed by area.

## Discussion

Pharmacy encompasses a wide range of scientific and professional disciplines. As a result, the research interests of academic staff are diverse. Students may, therefore, be offered final-year research projects within many different fields of study. In 2001, a new system for allocating students to projects was introduced within

Table VI. Mean percentage project marks for students within each type of Research Area corrected by year-three performance (number of students per area).

| Research Area | 2002/2003 | 2003/2004 |
|---|---|---|
| Computer | 66.6 (12) | 65.8 (12) |
| Laboratory | 72.7 (43) | 69.1 (33) |
| Practice | 65.7 (54) | 67.7 (63) |

Table VII. Mean percentage project marks for students within each Research Group corrected by year-three performance (number of students per group).

| Research Group | 2002/2003 | 2003/2004 |
|---|---|---|
| Dosage form design (DFD) | 75.1 (18) | 61.8 (14) |
| Medicinal chemistry & phytochemistry (MCPH) | 69.9 (15) | 78.3(11) |
| Pharmacology (PCOL) | 72.6 (10) | 69.3 (8) |
| Quantitative structure–activity relationships (QSAR) | 63.2 (5) | 64.8 (5) |
| Information technology & educational development (ITED) | 68.9 (7) | 66.6 (7) |
| Pharmacy practice secondary care (PPSC) | 65.5 (21) | 67.4 (20) |
| Pharmacy practice primary care (PPPC) | 65.8 (33) | 67.8 (43) |

this institution. The system aims to provide as much choice as possible to students within the constraints imposed by staff and resource limitations. The system continues to operate satisfactorily, with a large majority of students consistently attaining their first or second choice research group, as evidenced by a previous study (Rowe & Mottram, 2003) and by data from this study. Students, therefore, undertake a project within a discipline of their choice, a situation that anecdotal evidence suggests leads to a fulfilling experience for the student. Furthermore, the selection method results in an equitable distribution of students between Research Groups with respect to their overall level of academic achievement up to the end of their third year of study. Students experience a successful outcome as indicated by mean marks in the upper second or first class range that were awarded to students within this study.

The problem of benchmarking assessments for students undertaking projects has been reported previously (Pepper, Webster, & Jenkins, 2001). These authors highlighted the value of using written criteria by which dissertations would be assessed. In this study, using a marking scheme, based on generic criteria (Rowe & Mottram, 2003) has ensured that mean marks for projects across research groups have been generally consistent. The number of students in each research group varied between 5 and 43. Within any group of students one would expect a mix of academic ability. Therefore, one particular group may contain a higher than average proportion of students with a greater or lesser degree of academic ability. This may bias the mean mark for projects within that research group. In comparing research group marks, the general level of academic ability needs to be taken into account. One way of achieving this is though factorizing individual student's project mark by their mean third year mark before calculating the mean marks per project research group (Selvin, 1995).

Using this system, re-calculation of mean marks for research groups showed that in each of the two cohorts of students studied, there was a research group with a statistically significant higher mean mark than other research groups. For 2002/2003 this was DFD and for 2003/2004 this was MCPH.

By using this quality assurance procedure for project allocation and assessment, the research project co-coordinator was able to identify areas of both good practice and of concern. The project co-coordinator had the evidence with which to consult with the respective Research Group leaders and, where appropriate, individual project markers to ascertain the reasons for exceptional performances and to suggest remedial action where necessary.

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