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Exploring relationships between coursework and examination marks: A study from one School of Pharmacy

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Abstract

This study was conducted in order to investigate relationships, if any, between examination and coursework performances, following the observation that a significant number of M.Pharm students achieved high coursework marks during a semester, but then performed poorly in the end-of-semester examinations. Given that the two assessment modes generally tested the same knowledge base and skills, it was thought that a diligent and proper conduct of coursework (which would attract high marks) would enhance learning which would, in turn, be reflected in a good examination performance. To explore correlations between the two modes of assessment, the marks of students in all 4 years of the M.Pharm degree for a particular academic session were compared and the coursework and examination requirements as well as the factors that could contribute to differences in assessment scores were analysed. Coursework marks were found to be higher than examination ones and while the examination results ranged from fails to first class, the coursework marks were clustered, mostly between 60 and 80%. Pearson analysis revealed only a weak correlation between coursework and examination marks of individual students. The strength of the correlation depended on the year of study, whether the module was a core or an optional one and on the nature of the coursework. In this paper, the findings and the contributing factors are discussed. In addition, suggestions on ways of diverting student focus from coursework marks to the learning event are made.

Keywords: *Examination, coursework, assessment, marks, correlation*

Introduction

It is generally accepted that coursework assessment yields higher marks than unseen examinations (Chansarkar and Raut-Roy 1987, Gibbs and Lucas 1997). In recent years, analysis of the examination and coursework marks achieved by pharmacy undergraduates at the School of Pharmacy, University of London, shows that this holds true. Anecdotal evidence suggests that this is also indicative of pharmacy degrees in other Schools of Pharmacy in the UK and abroad (personal communication, Academic Pharmacy Group, Royal Pharmaceutical Society of Great Britain, Easter Conference, Brighton, 14–16 April, 2004). In fact, it has been argued that the upward drift of degree results over the last 20 years in the UK is due to the inclusion of coursework and the "reduced salience of the unseen examination" (Johnston 1994).

It is fair to expect coursework marks of individual students to be higher than their examination scores (for example, because of availability of resources such as time, books, peers, tutors) or when different skills are being tested, for example, preparation of extemporaneous pharmaceuticals as coursework. However, one would still expect a correlation between a student's coursework and examination marks, if the two assessment modes test the same knowledge base, similar skills (e.g. the ability to analyse data) and if the coursework is designed to be formative and help student learning.

It seems logical that if a student worked consistently during a semester and thereby achieved high marks for their coursework assessment, they would be prepared for the end-of-semester or year examination and would do well in those examinations (i.e. achieve high marks). It is assumed here that high examination marks reflect learning.

It was surprising, therefore, to observe that the coursework marks of a particular year group at the School of Pharmacy, University of London, were

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consistently high (i.e. in the 60 and 70% ranges), yet many of the students failed the examinations (which have a pass mark of 40%). Analysis of the coursework and of the examination papers and discussions with colleagues revealed that much of the assessed coursework is aligned to the examination questions and that one of the purposes (some would say, the main purpose) of coursework is to help students learn, as they do the work and receive feedback on their performance. Therefore, it was surprising that the examination and coursework scores deviated in so many cases.

Aim of study

In order to understand why some of the high coursework mark achievers were failing their exams, it was decided to investigate the relationship, if any, between coursework and examination marks of the M.Pharm undergraduates (years 1–4 of the academic session 2002–2003) at the School of Pharmacy, University of London. The objectives were to:

(1) Systematically investigate whether there was a discrepancy between examination and coursework marks,
(2) Determine whether the discrepancy, if any, between the two scores changes as the students progress from year 1 to 4 of the degree programme;
(3) Explore the factors contributing towards any discrepancy;
(4) Analyse one of the elements of the M.Pharm degree in greater detail, this element being the one in which the author was the most involved teacher.

At the School of Pharmacy, the M.Pharm degree is taught over four years (eight semesters) in Courses A–G, where A–E, F1 and F2 relate to semesters 1–7, respectively, while course G runs over semesters 7 and 8 (as shown in Table I). Courses A–E and G are multidisciplinary and consist of the different components of the M.Pharm degree (i.e. pharmaceutics, chemistry, pharmacology, pharmacy practice, etc.), while F1 and F2 are optional modules, (i.e. nutrition, cancer, drug delivery and targeting, travel medicine, paediatric pharmacy, etc.). In general, the optional courses are taken by cohorts of approximately 30 students, while the "core" courses are taken by about 180 students (Course A) to 140 students (Course G). The end-of-semester examinations consists of two or three closed-book papers while the coursework conducted during the semester consists of a wide range of exercises, such as, practical write-ups, tutorials, calculations test, dispensing practicals, essays, presentations, prescription management, research projects, group work, clinical visit reports, etc. as detailed in Table I.

Methods

The examination and coursework marks of the years 1–4 of the academic session 2002–2003 were

Table I. Nature of coursework in Courses A–G of the M.Pharm degree 2002–2003.

Course	Exams (Papers)	Nature and amount of assessed Coursework
A Year 1, semester 1	2 papers	18 practicals, of which, 9 are completed in class and handed in at the end of the class; 2 are written up and the reports are self-assessed (20%) and knowledge and skills are assessed via a test (80%); 7 are assessed on the completion of a write-up folder (10%) and a test based on the practical (90%).
B Year 1, semester 2	2 papers	15 practical write-ups, 6 tutorials, CAL sessions, practical theory test, dispensing calculations test, 1 4 h dispensing practical assessment
C Year 2, semester 1	2 papers	6 practical write-ups; 1 essay; 1 case study; 2 MCQ tests; batchsheets to be completed for 4 sterile products practicals and a 2 h theory test based on the latter practicals.
D Year 2, semester 2	2 papers	11 practical write-ups; 1 coursework test based on 5 practical write-ups; 1 coursework test based on 3 practicals; prescription management in labs; a significant report incorporating chemistry, pharmacology, pharmaceutics and practice aspects of certain drugs; visit to Chelsea Physic Garden
E Year 3, semester 1	2 papers	2 essays; 3 MCQ tests; 3 practical write-ups; medicines management (presentation); 6 objective structured pharmaceutical assessment.
F F1—Year 3, semester 2; F2—Year 4, semester 1	2 papers	Research project—70% Other coursework in 2 F options—various types of coursework depends on option—30%
G Year 4, semesters 1 and 2	3 papers	Group work and report; case presentation portfolio; Clinical visits; 3 essays, 3 reports on identifying drugs; Seminar report; role play and video

compared. To enable visualisation of the relationship between examination and coursework scores of individual students, the two scores were plotted on the *y*-axis against student number (*x*-axis). For the purposes of this study, a student number was assigned to each student based on their examination marks; the student with the lowest examination score was given number 1, the student with the second lowest exam score was given number 2 and so forth. Thus, from the graphs, the two scores (exam and coursework) of each student can be easily visualized by drawing a vertical line upwards from the student number. For example, in Figure 1, student number 51 achieved a score of 42 and of 50 for the examination and for the coursework, respectively. There was an equal number of examination and coursework marks in each plot since students who withdrew from an examination or did not complete coursework were not included in the study. The mean coursework and examination marks for each student were used; Table I shows that the mean examination mark related to two or more examination papers, while the mean coursework mark was obtained from a wide range of coursework conducted during the semester. Most of the coursework was open-book.

To determine whether the relationship between exam and coursework marks changes as students progress from first to final year of their studies, the marks achieved in Courses A–G (year 1–4) were plotted. These plots do not relate to the same cohort of students as all the marks were of the academic year 2002–2003. However, similar trends observed in different years justify this approach. In addition, the syllabus and assessments change from year to year. Analysis of a recent year was important to understand the current situation.

In order to understand the possible reasons for the discrepancies between examination and coursework marks, 23 second year students were shown the plots of coursework and examination marks and were asked to individually list reasons for the data. This was conducted at the beginning of a tutorial session. The opinions of many other students and colleagues were also sought informally, in one-to-one conversations.

Results and discussion

Mean examination and coursework marks of individual students are shown in Figures 1–7. Analysis of the mean examination and coursework marks showed that throughout the M.Pharm degree course, coursework marks were higher than examination marks for the majority of students.

This was in itself not surprising. The teachers thought that reasons for higher coursework marks include the fact that in coursework assessment often a very small component of the syllabus is being assessed in any one piece of work, coursework is relatively "easy", especially in the earlier years of the degree and it is also generously marked. Access to computers and software enable students to produce "high quality" coursework which often exceeds the teachers' expectations and thus leads to higher marks. Students have access to teachers to ask for clarification of the requirements for any piece of coursework. Students also have access to their peers (in their own and in other year groups) who can advise and offer coursework reports that have already been marked and commented upon. It is also known that in other settings and colleges, coursework reports are sold to students in lower years (personal communication, meeting entitled "Comparative Teaching Methods and Study Skills", International Student House, 30 May 2001). In contrast, examinations test a larger part of the syllabus; examination questions which span different areas of the syllabus seem difficult for many students who cannot integrate and apply knowledge across subjects and cannot express themselves clearly.

Students thought that the discrepancy between coursework and examination marks is due to the fact that exams are difficult, stressful (which contributes to low marks), time-limited and require a lot of knowledge.

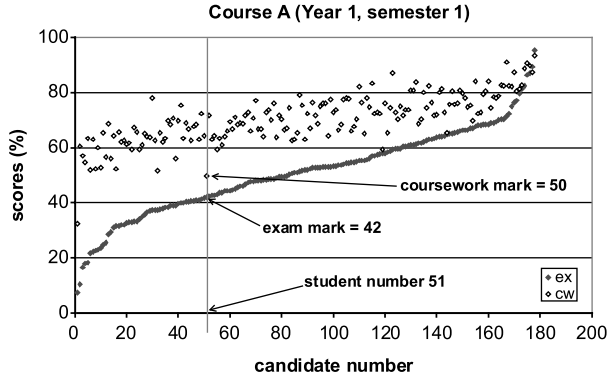

Figure 1. Coursework (◇) and exam scores (◆) of first year students; Pearson correlation between exam and coursework scores = 0.816.

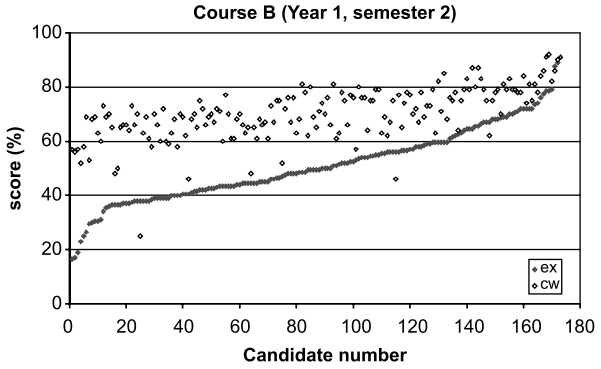

Figure 2. Coursework (◇) and exam scores (◆) of students in course B; Pearson correlation between exam and coursework scores = 0.676.

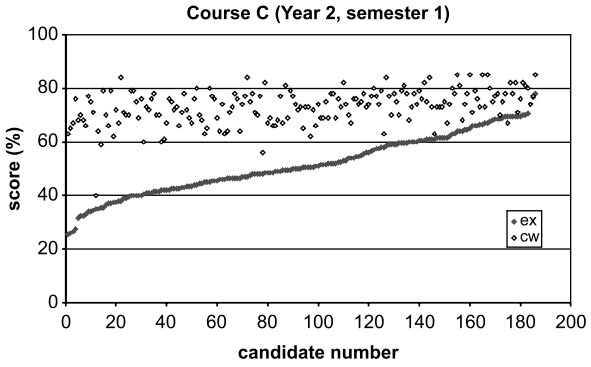

Figure 3. Coursework (◇) and exam scores (◆) of students in course C; Pearson correlation between exam and coursework scores = 0.426.

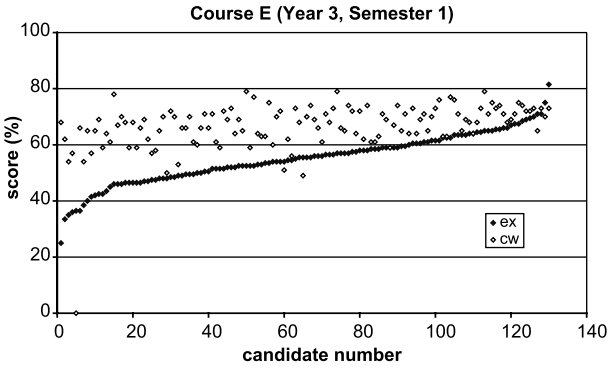

Figure 5. Coursework (◇) and exam scores (◆) of students in course E; Pearson correlation between exam and coursework scores = 0.426.

Students claim there is insufficient time to revise for exams, especially, when there is so much coursework to be submitted. In contrast, coursework is open-book, easier, not as stressful as exams and is often conducted while the subject is being taught. Students have sufficient time and can use any resource available, including peers. The latter resource was one of the most common reasons, exemplified by statements such as:

> 'Groups of students often work together. This means that the person who does the least work gathers the information from other students. In an exam, they cannot work with others.'
>
> 'Group discussion allows a student to do coursework well but this is not practicable in exam.'
>
> 'Not doing it by themselves.'
>
> 'In coursework, everyone helps each other and share ideas to get good marks. But during exam period, people may feel that there's too much work to do and so cannot be bothered to do it.'
>
> 'Coursework is easier, student get access to references and then rephrase (copy).'

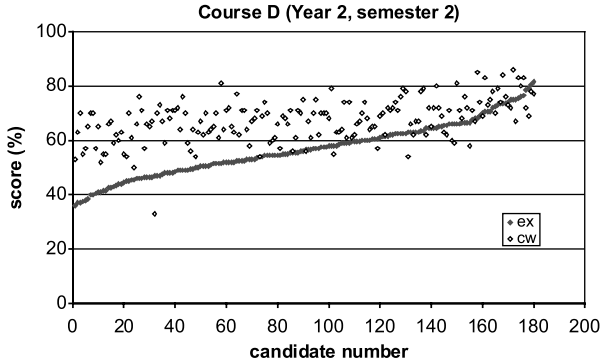

Figure 4. Coursework (◇) and exam scores (◆) of students in course D; Pearson correlation between exam and coursework scores = 0.506.

It is interesting that instead of using the words "copying", "cheating" or "plagiarism", students used words such as "help" and "group discussion". It is known that cheating among pharmacy students occurs as prevalently as in other disciplines (Aggarwal, Bates, Davies, Khan 2002a, Aggarwal , Bates , Davies 2002b). It is possible that many students surveyed did not admit to and/or report cheating as a reason for the discrepancy between examination and coursework marks because they were inhibited by the surveyor (me, a teacher). It is also possible that many students genuinely think in terms of "helping one another" (or oneself) and "group discussion", even when the "copying" is the major part of the transaction and "helping and/or group discussion" is minimal.

There was a weak correlation between examination and coursework marks of all semesters; the strength of the correlation depends on student ability, the year

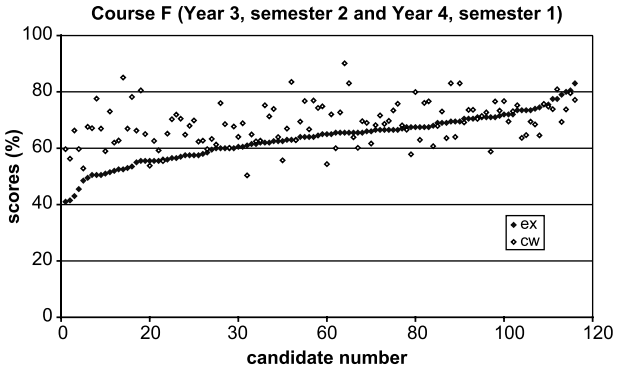

Figure 6. Coursework (◇) and exam scores (◆) of students in course F; Pearson correlation between exam and coursework scores = 0.359. The score for the research project that was conducted at the School in year 3 was incorporated within the coursework component of Course F and it made the bulk (70%) of the coursework marks. Students who conduct their research projects outside the institution, as part of their extra-mural placements were excluded from the plot in Figure 10 as their projects and examinations do not correlate exactly with the others.

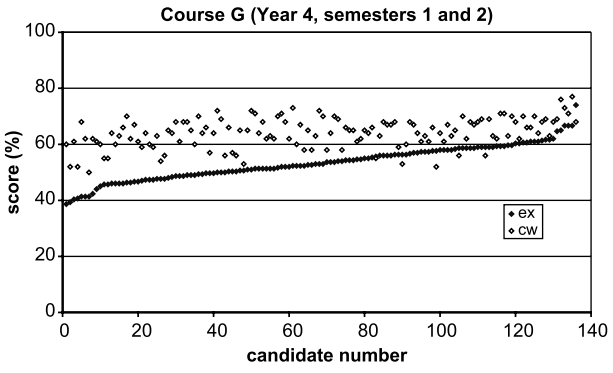

Figure 7. Coursework (◇) and exam scores (◆) of students in course G; Pearson correlation between exam and coursework scores = 0.419.

of study, nature of coursework and whether the course was a core or an optional module. The correlation can be seen from the slopes of the examination and coursework marks plots (Figures 1–7) and from the Pearson correlation coefficients given in the figure legends. The most able students performed very well in the two assessment modes while less able students performed more poorly in both. The correlation is not very strong, as the weakest students fail the exams (score $<$ 40%), but their coursework marks could be quite high (e.g. 60–70%). In addition, the coursework marks can be seen to be clustering; most of the marks being between 60 and 80% (Figures 1–7), while the examination marks range from fails ($<$40%) to first class scores (= or $>$ 70%).

Since, much of the coursework and examination assessments test the same knowledge base and skills, the large gap between examination and coursework marks of students who fail the examinations but perform well in coursework shows that these students are "doing" the coursework, but not learning from it. As one student pointed out, she "does" the coursework during the term and then forgets. By the time she has to sit for the exams, she has to prepare for them a new. Even though the teachers are using the coursework to promote student learning, many students do not learn from coursework. These students are adopting a surface learning approach or other strategies, such as cheating, which earn them high coursework marks; however, the absence of understanding is leading to failure in the examinations.

It is known that students are more likely to adopt surface learning strategies when the workload is excessive or when inappropriate forms of assessment are used (Ramsden 1984). The study also confirms the work of Miller, Imrie, Cox (1998) who stated that continuous assessment tests are seen as "heavy *millstones* rather than important *milestones*" as the students see coursework just as an assessment to be negotiated rather than as a learning opportunity. Table I shows that the coursework marks are derived from a very large number of assessed work. Thus, during a semester, students are constantly "doing" coursework which has to be submitted for specified deadlines. The fact that most of the coursework is assessed leads to the focus being on marks rather than on learning.

From the figures, the largest discrepancy between examination and coursework marks seems to be in the first year of study. For example, in the first semester, 71 (out of 177) students failed the exam (score $<$ 40%); of these students, only three failed the coursework (score $<$ 50%). The mean examination and coursework marks for the whole cohort were 44 and 69%, respectively. The high coursework mark is a result of relatively easy coursework in the first year, part of which is also self-marked. This is a deliberate policy of some staff to encourage students and build their confidence early on in the degree course (personal communication, B Pearce, January 2004). It is also possible that student cheating is more prevalent in the earlier years of the degree due to the nature of the coursework and/or the student being less engaged in their studies. The largest discrepancy in the first year (due to low examination marks) can also be explained by the fact that these are the first university exams taken by students who have not realised the amount of preparation work needed. Students who fail invariably quote the fact that they did not work hard enough for the exams.

Student learning about examination techniques, such as the standards required to pass exams, revision and examination techniques and their increasing maturity as they progress from year 1 to 4 of the M.Pharm degree, contributes to a decreasing gap between the coursework and exam marks from year 1 to 4, as the average examination and coursework marks, respectively, increase and decrease slightly (Figure 8). The increase in examination marks with year of study is further enhanced because a small cohort of weak candidates has left by year 3 and 4. The decrease in coursework may be influenced by the more challenging nature of coursework in the later years, such as dissertations and research projects and may be marked less leniently compared to the earlier years.

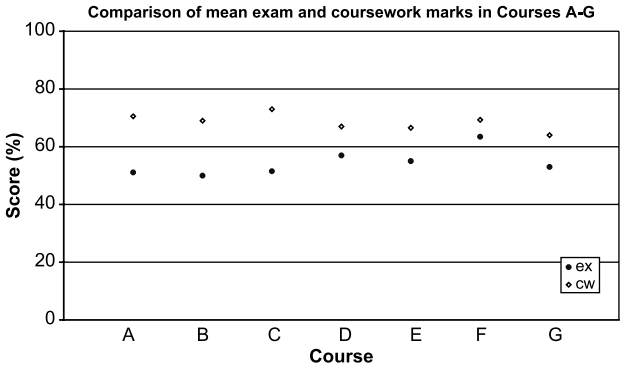

Figure 8. Comparison of the mean exam and coursework marks of the year groups in Courses A–G.

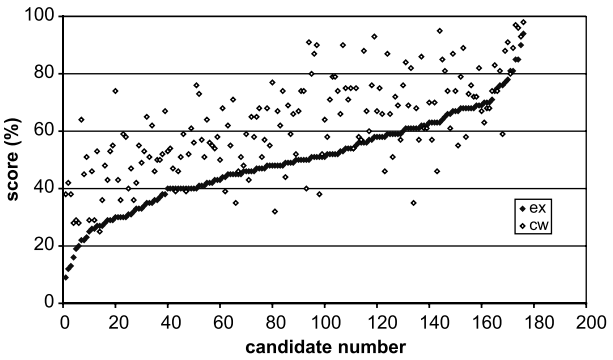

Figure 9. Coursework (◇) and exam scores (◆) of a particular module in Course A. Pearson correlation between exam and coursework scores = 0.70.

The gap between coursework and examination marks was smallest for the optional course (Figure 8). Students tend to perform well in the option examinations as they are self-selected based on their interest and ability and consequently demonstrate high motivation towards learning. This is further helped by small class size, which improves the teacher-student relationships. In addition, weaker students can be monitored more closely and can receive help when needed. The mean examination mark for Course F (the optional modules) is indeed the highest of all the examination marks (Figure 8).

Analysis of scores for individual pieces of coursework and the corresponding examination paper revealed that the strength of the correlation between the scores depended largely on the nature of the coursework. For example, there was a good correlation between the examination and coursework marks of one of the components of Course A (Figure 9, Pearson correlation = 0.70). In this case, the coursework mark was derived largely (90%) from a test which was conducted under examination conditions. Predictably, the coursework marks ranged from fails to first class, just like the examination marks, with the strongest candidates achieving the highest examination and highest coursework marks. Students could not receive any help from the usual resources (e.g. books, tutors or peers) for this particular coursework, which removed some of the contributing factors for the usual discrepancy between coursework and examination marks.

Analysis of the author's teaching module

Analysis of the module where the author is the most involved teacher was conducted to gain greater insight into the poor correlation between examination and coursework marks. The module is part of Course C (year 2, semester 1) and is called the formulation of liquid dosage forms. Students learn topics like the science of solutions, solubility, dissolution rates, emulsions, suspensions and DLVO theory in 12 lectures, three practicals (solutions, suspensions and emulsions) and three tutorials. The practical work is written up and is submitted for marking 2 weeks after the practical session. Students generally spent 6–8 h per practical write-up. According to student feedback questionnaires, writing up of the laboratory work enabled the students to learn the subject matter well, which was exactly what the author had planned. The examination question was well-aligned with one particular practical (as shown in Table II) and it was expected that this examination question would be well-answered by most students.

Indeed, 115 out of 163 students who attempted the question achieved a score of greater than 50% (Figure 10). The surprise was that 22 students achieved less than 40% (i.e. failed the examination question), yet the practical report marks of 21 of these students were equal to or greater than 60%. Two of the students even had coursework scores of 90%. There does not seem to be any correlation between the scores for this particular practical write-up and the examination question (Figure 10). Once again, high coursework marks are bunching between 60 and 100%, while the exam marks range from fails to first class. The discrepancy between examination and coursework marks is again greatest for the weakest students. If exam performance is an indicator of learning, the weakest students do not seem to be learning from the coursework. Analysis of the other

Table II. Alignment between an examination question and Practical 3 of Course C.

Practical 3	Examination question
In this practical, students have to: (i) determine whether a given emulsion is a water-in-oil (w/o) or an oil-in-water (o/w) system (ii) calculate HLB values of different surfactant mixtures and prepare emulsions (iii) assess the viscosity of a number of continuous phases and determine the effect of viscosity on emulsion creaming ratios (iv) determine the effect of homogenization on emulsion creaming	Students were given a formula and asked: (i) whether the emulsion was expected to be a w/o or o/w system (ii) how would they determine whether the emulsion was a w/o or an o/w system (iii) to calculate HLB of the given surfactant mixture (iv) whether emulsion creaming is a problem and to discuss ways of reducing the creaming rate and, (v) to discuss other types of physical instabilities in emulsions.

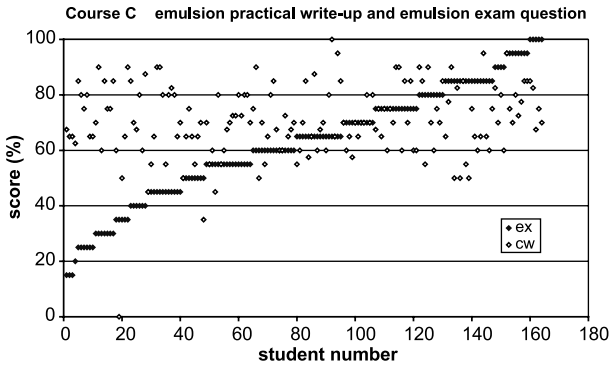

Figure 10. Coursework (◇) and exam scores (◆) of a practical write-up and an aligned examination question in Course C. Pearson correlation between exam and coursework scores = 0.13.

two practical write-ups and corresponding examination questions showed similar disparity (i.e. relatively high marks for coursework which was not always translated into high examination marks).

The high marks for the laboratory reports could only partly be due to generous marking. The majority of laboratory reports were well-written and well-presented. From the feedback questionnaires, it is known that many students spent a great deal of time and effort on the write-ups. It is also known that students were very conscious that the marks counted towards the final degree. A number of students compared their write-ups and marks with those of their colleagues and queried differences of one or two marks when they thought both write-ups deserved the same marks. It transpires that many students saw the coursework primarily as a means of accumulating marks rather than as a learning event. Their focus on marks instead of the learning event is probably responsible for activities such as cheating, adoption of surface learning strategies ("doing" the coursework and getting it out of the way), resulting in some of the contributing factors for the weak correlation between coursework and examination marks discussed above.

What can we do to replace student focus from marks to learning?

Diverting the student focus from accumulating marks toward learning should theoretically help the weakest students to perform better in examinations. Teachers could enable this by:

(1) Making the link between learning from coursework and success in examinations explicit to the students, as suggested by Carroll and Appleton (2001);
(2) Significantly reducing the amount of assessed coursework. The total amount of coursework could remain the same, but by marking a smaller proportion of the work, we can firstly, reduce the marking load which will allow more time to give feedback and secondly, reduce the time students spend on "doing" coursework and chasing deadlines,
(3) Designing out opportunities for cheating; for example, by changing the nature of the coursework from previous years to eliminate the possibility of copying from students in higher years. If this cannot be easily done, we could set artefacts which would capture plagiarism of previous years' scripts;
(4) Changing the way in which some of the coursework is marked. For example, orally assessing students in some of the practical classes (rather than marking the practical write-up which is submitted later) is quicker and reliable. The student—not helpful peers—is assessed and this allows the teacher to check individual student understanding and give immediate feedback;
(5) Designing more of the coursework to be integrative across the different disciplines in pharmacy. This would require students to spend more time thinking about the broader picture, make connections between the different components of the syllabus and adopt a deep learning approach.

Conclusions

This investigation explored the wide gap between examination and coursework scores, especially of the weakest students, as it appeared that the conduct of coursework did not necessarily lead to learning. It was found that, while there was a weak correlation between examination and coursework scores of individual students reading pharmacy at the School of Pharmacy, University of London, the majority of the coursework marks were bunched between 60 and 80% while the exam scores ranged from fails ($<40\%$) to first class ($>$ or $= 70\%$). The ubiquity of high coursework marks was, to a large extent, assigned to easy, generously-marked coursework, group discussion of work and helpful peers, especially in earlier years of the degree programme. The fact that high coursework marks were not always accompanied by high examination marks showed that learning was not always happening during the management of the coursework. This could be due to the fact that, for many students, the focus is on marks and not on whether they learnt from the coursework while they are continually assessed. A few suggestions have been made to help remove the student's focus from coursework marks and gear it towards the learning opportunities.

Acknowledgements

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