

## Short Report

# Teaching Extemporaneous Preparation in UK Schools of Pharmacy

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**Aim:** To establish the nature and content of contemporary teaching of extemporaneous preparation/dispensing in UK schools of pharmacy.

**Method:** A self-completed questionnaire was issued electronically and via post to the member of academic staff responsible for the design and development of extemporaneous preparation teaching within each UK school of pharmacy. A 100% response rate was achieved.

**Key findings:** Extemporaneous preparation is currently taught in all 16 UK schools of pharmacy, with all students gaining practical experience of this type of dispensing. Practical classes, which encompassed 62% of the total time spent on teaching extemporaneous preparations by all the schools, were the most popular mode of teaching used. Students spent on average 29.7 h in practical classes which comprised between 26 and 50 students in the majority of cases, with a mean staff/student ratio of 1:11.5. All schools included registered pharmacists in their teaching teams which comprised predominantly academic staff, teacher practitioners, laboratory assistants and technicians and postgraduate demonstrators. The most popular extemporaneous products were solutions and suspensions, prepared in all schools, and the least common were gels and pastes. All schools set a practical assessment, however only nine respondents were confident that a student of average ability would, on graduation, be able competently to dispense extemporaneously. In terms of course development, 12 schools had introduced changes into the course as a result of the Peppermint Water case. However, the hours spent in extemporaneous practical classes had generally decreased or remained constant over the past five years. Most respondents envisaged the hours would remain constant in the future.

**Conclusion:** Currently, all pharmacy students in the UK are taught and assessed in the practical aspects of extemporaneous preparation and dispensing. Courses

vary in content and emphasis throughout the UK, but they have in common an emphasis on practical skills, high staff/student ratios, the types of products made and pharmacist representation in course design and teaching.

**Keywords:** Extemporaneous preparation; Pharmacy; Pharmacy education; Survey

## INTRODUCTION

In the 1940s and 50s, it was essential for pharmacists to be trained in the extemporaneous manufacture of products such as creams, powders, suspensions, emulsions, pills, solutions and ointments. However, the rapid expansion of the pharmaceutical industry in the latter half of the twentieth century, with medicines manufactured and packaged by the pharmaceutical industry, has resulted in the reduction, to almost negligible levels, of opportunities for pharmacists in community and hospital pharmacy to prepare medicines extemporaneously. Currently, unlicensed medicines or specials, including those extemporaneously prepared form about 0.05% of all prescriptions written (Department of Health, 2001). Using data collected in 1993, Savage (1999) calculated that pharmacists in England spent on average 0.2% of their time on "compounding", i.e. traditional extemporaneous preparation.

Industrially produced medicines offer clear advantages for patients and pharmacists. In particular, the quality of products manufactured under "Good

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Manufacturing Practice" is better assured, and risks of adverse events such as cross-contamination are removed. Moreover, the time involved in sourcing materials, preparing the products and recording details of extemporaneous dispensing is prolonged (Cruickshank, 2003) and it has been estimated that to extemporaneously prepare a "special" and record the process, would take on average no less than 40 min (Fawdry, 2003). Yet such activity is not adequately remunerated.

As pharmacists develop their role, becoming more patient and information-centred, for instance embracing medicines management and prescribing, "technical" activities such as extemporaneous preparation, may be regarded as anachronistic. However, it has been argued that as a result of technological change, and pursuit of new roles, pharmacy as a profession is facing potential de-skilling (Harding and Taylor, 1997). To arrest the decline in their professional status pharmacists should capitalise on their unique skills. At the forefront of these skills is the pharmacists' ability to formulate and manufacture medicines, and extemporaneously produced preparations are a tangible demonstration of pharmacists' unique skill and knowledge.

Areas of dispensing where extemporaneous preparation still remains particularly important are paediatric and veterinary pharmacy (Lust, 1994; Fenton-May, 2003). Moreover, a product made within a pharmacy costs the NHS significantly less than if produced by a "specials" manufacturer (Taylor and Harding, 1999; Department of Health, 2001), whilst patients benefit through receiving individualized medicinal products, hand crafted for them by a specialist.

### The Peppermint Water Case

In May 1998, a three-week-old child died after receiving peppermint water, prescribed to treat colic when he was four days old (Pharmaceutical Journal, 1998a). A pre-registration student had prepared the peppermint water using an outdated formula. The volume of concentrated chloroform water used was that stated for double strength chloroform water in the formula, with the result that the product contained an excessive amount of chloroform. The student's tutor pharmacist signed off the product without inquiring about how the product had been made up. Although both the pharmacist and pre-registration trainee were cleared of manslaughter charges, they were fined after pleading guilty to a charge of not supplying "a medicine of the nature or quality demanded" (a Medicines Act offence) (Pharmaceutical Journal, 2000a).

During the trial, the court was told that there was real doubt over whether the student's university and

pre-registration training would have left him fully appreciable of chloroform water in its concentrated and other forms. At the end of trial, the Royal Pharmaceutical Society of Great Britain's (RPSGB) director of professional standards said that "*The Boots peppermint water case raises questions over whether community pharmacists should dispense extemporaneously*".

Reflecting on the case, several pharmacists questioned undergraduate training. For instance, Roome (2000) felt that if the appropriate subjects were taught, the baby's death might have been prevented. The National Pharmaceutical Association (NPA) board of management also questioned the adequacy of the basic training of pharmacy undergraduates and pre-registration trainees (Pharmaceutical Journal, 2000b), believing that the peppermint water case had highlighted deficiencies in baseline knowledge and competencies. In addition, there were concerns about the general preparedness for practice of pharmacy undergraduates, and whether they were given sufficient tuition on the calculation of quantities of ingredients and compounding skills.

In response to the case, the Council of the RPSGB published a document laying down standards of good professional practice for the dispensing of extemporaneous preparations (Pharmaceutical Journal, 2000c). This was incorporated into "Medicines, Ethics and Professional Practice: a Guide for Pharmacists" in the January 2001 edition (Royal Pharmaceutical Society of Great Britain, 2001).

### The Contemporary Debate

Concerns about the teaching of extemporaneous preparation have recently reemerged after a pharmacist writing in the *Pharmaceutical Journal* questioned whether the preparation of simple formulae really was beyond pharmacists, and whether extemporaneous dispensing was still being taught (Wragg, 2003). Another pharmacist responded that although extemporaneous dispensing is taught, the time available for such teaching is only a small proportion of the total pharmacy degree programme (Neill, 2003).

The *Subject Benchmark Statement for Pharmacy* (Quality Assurance Agency for Higher Education, 2002) states under "Pharmacy-related practical skills", that the student must be taught the "preparation and presentation of medicines, by manufacture and extemporaneous dispensing...". There is no specific mention of the subject in the *Indicative Syllabus for UK Pharmacy Degree Courses*, but listed in the outcomes of the pharmacy degree course, it is stated that "the graduate has the capability to prepare extemporaneously any medicine for which this would be regarded as the normal

means of provision..." (Royal Pharmaceutical Society of Great Britain, 2002).

Currently then, there is clear concern regarding the existence, quantity and content of UK undergraduate teaching of extemporaneous dispensing. However, there are no published studies in this area. Consequently, this study sought to collect appropriate data to provide a profile of contemporary extemporaneous preparation teaching in UK schools of pharmacy.

## METHOD

A self-completed questionnaire, designed to collect information on pharmacy undergraduate courses in extemporaneous preparation/dispensing, and a covering letter was sent by e-mail and post to the member of staff responsible for the teaching in this subject area at each of the 16 UK schools of pharmacy. A reminder was sent to non-respondents after seven days. Responses were received by E-mail, post or fax, and a 100% response rate was achieved. The questionnaire comprised 17 questions and included a section for respondents to add free text (additional comments) regarding the subject matter of the investigation.

For the purposes of this study, extemporaneous preparation was defined as: "small scale manufacture (i.e. capable of manufacture within a community pharmacy setting) of: solutions, suspensions, emulsions, creams, ointment, pastes, gels etc." Granules, tablets, capsules, aerosols, novel drug delivery systems or sterile products, were excluded as they were considered not capable of manufacture in the "typical" pharmacy environment.

## RESULTS AND DISCUSSION

### Details of Respondents

Twelve of the 16 individuals responsible for teaching extemporaneous preparation were either Lecturers or Senior Lecturers (Table I). Of the remaining respondents, one was a Principal Lecturer, one a Reader and two were Teacher Practitioners. No Professor, the most senior grade of academic staff, was responsible for such courses.

TABLE I Academic title of individual responsible for design and development of extemporaneous preparation teaching

Academic title	Number
Lecturer	7
Senior Lecturer	5
Principal Lecturer	1
Reader	1
Professor	0
Teacher Practitioner	2

TABLE II Total number of years the respondent has taught extemporaneous preparation

Number of years	Number
<5	2
5-10	4
11-20	7
21-30	2
>30	1

Although the majority of the staff responsible for extemporaneous dispensing were at the lower end of the academia hierarchy, Table II shows, they had a wide range of experience. The length of time they had been teaching extemporaneous teaching ranged from six months to 32 years with a mean ( $\pm$ S.D.) of 13.6 ( $\pm$ 9.0 years). Extemporaneous preparation is a traditional pharmacy subject. Therefore, the subject may be preferred by, or even delegated to, staff seen as having the appropriate length of experience. Given that this subject is taught by experienced staff, its future could be threatened by the age profile of academics, as it is estimated that by 2010 around 47% of academic staff in universities will be eligible for retirement (Macleod, 2001).

### Teaching Staff

In 14 out of the 16 schools of pharmacy, all the staff involved in the design and development of extemporaneous preparation teaching (e.g. module or teaching team leaders) were registered pharmacists. Only two schools stated that their design and developmental group for extemporaneous teaching contained only "some" registered pharmacists. No schools had a teaching group without any registered pharmacists.

The presence of registered pharmacists amongst those delineating what should and should not be taught in terms of extemporaneous teaching will determine the content and nature of the learning experience. They can draw on their own educational backgrounds and experiences in practice to ensure that courses are appropriate for pharmacists' professional needs.

In all 16 schools, academic staff were actively involved in the teaching of students (Table III).

TABLE III Staff teaching extemporaneous preparation

Position	Number of schools
Academic staff	16
Teacher Practitioner	12
Lab assistant/technician	10
Postgraduate student	8
External speaker/demonstrator	5
Scientific officer	1
Applications supervisor	1

TABLE IV Percent of teaching staff who are registered pharmacists

Pharmacists, %	Number of schools
<25%	0
25–50%	3
51–75%	2
76–100%	11

In the majority of schools, both teacher practitioners and lab assistants or technicians also had student contact. Eight schools used postgraduate students and five external speakers/demonstrators in their classes. Two schools stated that they also included other staff.

As the numbers of pharmacists employed by schools of pharmacy has decreased over recent years (Taylor and Harding, 2002), teacher practitioners have become an important resource of “professional” expertise, having current “practical” experience, which is made available to students, and staff. Together with external speakers and demonstrators, they can provide students with an insight into how the skills they are acquiring can be utilised in their future careers. Table III suggests these staff are used as a supplement to, rather than replacement for, a university employed academic staff.

Interestingly, lab assistants/technicians have student contact in the majority of schools. Traditionally, technical staff were predominantly involved in preparing classes, now, as in the health service, their full ranges of skills are being utilised, such that they may be involved in for example, assisting students in making products and assessment.

All schools had some registered pharmacists as part of the group of staff who delivered the teaching of extemporaneous preparations, with the majority having at least 50% pharmacists (Table IV).

Pharmacists have an appreciation of what extemporaneous preparation means to them as a professional, i.e. requiring a blend of technical and professional skills. Pharmacist teachers are able to draw on a unique combination of knowledge of formulation, physicochemical drug properties and legal and ethical issues. In such circumstances, student professionals undergo a process of socialisation: as they are taught “professional” skills through contact with pharmacists, they become inculcated with the social values, mores and practices associated with professional practice, acquiring, in the process, their distinct occupational identity (Taylor and Harding, 2002).

### Course Logistics and Content

Three schools reported that their course was delivered from a “mainly formulation science

TABLE V The year(s) of the M.Pharm. programme in which extemporaneous preparation is taught

Year of course during which extemporaneous preparation is taught	The total no. of years in which extemporaneous preparation is taught			
	1	2	3	4
Year 1	5	2	1	2
Year 2	3	3	1	2
Year 3	2	1	1	2
Year 4	0	0	0	2

perspective” with the focus predominantly on the technical preparation of medicines, and five from a “mainly pharmacy practice perspective”, which emphasises legalistic and therapeutic issues. In eight schools it was taught as an “approximately equal combination of practice and science”. This range of responses highlights differences between schools, and the unique nature of this subject area, bridging as it does pharmaceutical science and practice.

In ten of the 16 schools extemporaneous preparation is only taught during one of the four years of the M.Pharm. course (Table V). Five of these ten schools taught extemporaneous preparation in Year 1, three in Year 2, two in Year 3 and none in Year 4.

Three schools taught extemporaneous preparation during two separate years of the M.Pharm. course. In two of these schools, students are taught in Years 1 and 2, and in the other school in Years 2 and 3. One school, taught the subject during three separate years, these being the first three years of the course. The remaining two schools taught extemporaneous preparations in all four years of the course. Fourteen schools stated a specific reason for their choice of year(s).

In three schools the timetabling was determined by long established organisational practices. In other schools, integration of this subject in the curriculum for rational educational reasons was reported:

“...a means of combining practice and science and introducing pharmaceutical calculations.”

“...to introduce professional rigour at the earliest opportunity...”

“...is a logical progression after basic physical chemistry.”

“...the principles of disciplined working and GDP/GMP are needed for future years.”

One school in which this subject was taught across all four years did so in order:

“...to reinforce it within all practice modules.”

From Table VI it can be seen that a diverse array of teaching methods was employed. The mean ( $\pm$  S.D.) contact hours in this subject area were 41.6 ( $\pm$  30.4) with a range of 23 to 127 h. This represents formal student contact time, and does not take into account directed and self-directed learning by students.

TABLE VI Teaching methods and contact hours allocated to extemporaneous preparation

School	Lectures	Practicals	Demonstrations	Seminars	Tutorials	Problem-based sessions	Revision classes	Total
1	23	27	0	0	0	0	0	50
2	20	15	0	14	0	0	0	49
3	12	25	0	0	0	0	0	37
4	4	35	0	0	2	1.5	10.5	53
5	20	40	0	0	6	6	0	72
6	10	30	9	0	0	0	0	49
7	67	60	0	0	0	0	0	127
8	3	33	3	0	3	0	0	42
9	15	21	2	0	4	0	0	42
10	2	60	3	0	0	0	0	65
11	1	16	0	0	6	0	0	23
12	0	21	0	0	3	0	0	24
13	14	33	0	0	1	0	0	48
14	30	20	0	2	0	0	0	52
15	0	24	0	0	3	0	0	27
16	6	15	0	0	4	0	0	25
Total	227	475	17	16	32	7.5	10.5	785
Percent	28.9	60.5	2.2	2.0	4.1	1.0	1.3	100

On average, 61% of the hours allocated to the teaching of extemporaneous preparations by the schools were spent doing practicals. The second most common teaching method was lecturing, which comprised, on average, 29% of the students' time in this subject area. The remaining 10% of hours were allocated to tutorials, demonstrations, seminars, problem-based sessions and revision classes.

Students spent a mean ( $\pm$ S.D.) of 29.7 ( $\pm$ 14.0) hours in practical classes, but this ranged from 15 to 60h between schools. A practical skill is being learned, but practical sessions will also provide opportunities for students to develop other skills, such as problem solving.

Students spent a mean of 14.2h in lectures, with a very large range of 0 to 67h, between schools. These large differences may be due to differential interpretation of what an "extemporaneous preparation lecture" encompasses. Alternative teaching methods to practicals and lectures occupy only a small proportion of student contact. This may reflect the essentially practical nature of the subject, the opportunity with high staff/student ratios to employ methods such as problem solving within practical classes, or a preference of those experienced teachers responsible for these courses for traditional teaching methods.

#### Practical Class Size and Staff/Student Ratio

No schools had practical class sizes of fewer than 15 students. Four schools had classes of between 15 and 25, nine between 26 and 50 students and three between 51 and 100 students. No schools had classes of more than 100 students. Class size reflects a compromise between that which is optimal for teaching, and most efficient given constraints of space and time.

The mean ( $\pm$ S.D.) staff/student ratio was 1:11.5 ( $\pm$ 3.86), with a range of 1:6.3 to 1:22.5, indicating that students received a good deal of direct support, reflecting the commitment of individual teachers and institutions to this subject.

#### Dosage Forms Prepared

In all 16 schools, students extemporaneously prepared both solutions and suspensions (Table VII). Creams, ointments and emulsions were also produced in the majority of schools, with only a few requiring students to prepare suppositories, pastes and gels and dilute semi-solid preparations. Six schools reported that students produced "other" products, i.e. ear drops, powders and wrapped powders. It should be noted that these figures represent only those products made as medicines in the context of extemporaneous preparation/dispensing classes. Students may make other solutions, suspensions, emulsions etc., in other parts of the course, associated with formulation, drug delivery, physical and analytical chemistry, etc.

TABLE VII Products made by students in UK schools of pharmacy

Product	Number of schools	Average proportion of all products made (%)
Solution	16	27
Suspension	16	18
Ointment	15	13
Cream	14	17
Emulsion	11	7
Paste	6	3
Dilution of a semi-solid	6	6
Suppository	6	4
Gel	3	1
Other	6	4

Considering the UK as a whole (Table VII), of the products made the largest group were solutions. This may reflect the reality of what pharmacists' make in practice, and being relatively straightforward to prepare, allows students to quickly develop new skills. Suspensions, creams and ointments also form a large proportion of products made, whilst pastes and gels form a very small proportion. These proportions reflected the formularies in the British Pharmaceutical Codex 1973 (Pharmaceutical Society of Great Britain, 1973), which have more than 100 formulae for solutions, whereas there are eight formulae for pastes and only one for a gel.

### Methods of Assessment

All 16 schools assessed students' ability to dispense extemporaneously (Table VIII). All set a practical assessment. Given the need for students to acquire and develop practical skills to accurately and safely dispense extemporaneously, a practical assessment would seem the most appropriate method for testing the students' abilities.

Schools also set written (theory-based) and multiple choice assessments (MCQ). These may be in conjunction with the practical assessment or separate. Thirteen schools had a numerical/calculations assessment. Competency in numeracy/calculations is clearly seen as a key skill in this area, and is a transferable skill outlined in the QAA Pharmacy subject benchmarks. Moreover, calculations are a compulsory component of the pre-registration exam. Overall, this aspect of the pharmacy degree is heavily assessed, indicating that the schools perceived the importance and relevance of the subject in which students should demonstrate competence.

When asked whether they believed that their average student would be competent in extemporaneous dispensing on graduation, nine of the respondents stated that this would be so. Three however, stated that an average student would not be able to do so, and four were unsure. This is clearly an issue of concern, given that the RPSGB's accreditation documentation for pharmacy degrees, states in the outcomes of the degree course, that "the graduate has the capability to prepare extemporaneously any medicine for which this would be regarded as the normal means of provision,..."

TABLE VIII Method of student assessment in extemporaneous preparation

Assessment method	Number of schools
Practical	16
Calculation/numeracy	13
Written (theory-based)	9
MCQ	5
No assessment	0

(Royal Pharmaceutical Society of Great Britain, 2002).

However, as one respondent noted: "They may be competent the day after the exam but not two years later." Indeed, as with any aspect of the degree, competency comes with practice.

There was no clear correlation between those who believed an average student would not be sufficiently competent, and other factors such as the duration of the course, or the year in which it is taught. For instance, one respondent from a school with 35 h of practical classes in Year 2, recorded a "No". However, another respondent from a school with 27 h of practical classes in Year 1, thought that their students would be competent. Clearly these responses are opinions, rather than being based on any test of competency at the end of the degree programme.

### Course Development

Respondents from 12 schools stated that changes had been introduced to the course as a result of the Peppermint Water case. Only three schools had not introduced any changes, whilst one respondent was unsure as he/she had only recently become involved in the teaching of extemporaneous preparations.

The majority of changes were in emphasis rather than in content. For instance, the case was used to demonstrate the importance of numerical proficiency and accurate working:

"...the incident is used as an example of how important these skills are."

"...a greater emphasis on calculations and dilutions."

"...an emphasis on requirement of a complete and concise working formula for each preparation."

"...alteration in marking schemes penalising more heavily on inaccurate preparation of flavoured waters."

Four schools had introduced specific practical exercises with dilutions of concentrated chloroform waters, and one respondent also ensured that the dilution of chloroform waters was now tested in written and practical assessments. Another school changed the format of students' dispensing worksheets to require double signatures, whilst another introduced an additional year's extemporaneous dispensing. It is clear that the majority of schools have undertaken revision of their courses as a direct consequence of the case which highlighted the consequences of a serious error and led to public questioning of the adequacies of undergraduate training.

Only two schools reported an increase in the number of hours the students spent on the practical aspects of extemporaneous dispensing over the previous five years. One of these noted that the increase was only small. Five schools reported a decrease, whereas in

nine schools the hours remained the same. Thus, whilst the Peppermint Water case, which occurred in 1998, five years prior to this study, had resulted in changes in course content and emphasis in the majority of schools, few schools reported an increase in the time spent on the subject.

Five schools reported a decrease in teaching hours over the previous five years. Although the reasons for these decreases were not specified, this may reflect the apparent decrease in the importance of these skills within contemporary pharmacy, the need to introduce new material, or possibly staff turnover.

Thirteen respondents believed that the practical aspects of extemporaneous preparations would still be taught in five years time with the same contact hours per student. Three respondents predicted a decrease in hours per student. Of these, two reported a reduction in the previous five years and two have practical classes totalling 60 h each, and the third has 35 h. These are greater than the average total of 29.7 h for practical classes, and therefore there may be pressure to reduce hours.

It seems then that extemporaneous preparation and dispensing is not viewed as irrelevant or outdated, nor is it anticipated becoming so in the near future. Neither is the subject apparently in terminal decline due to the introduction of newer subjects, though one respondent stated:

"The subject is not under threat...yet."

Whilst another wrote:

"Pressure may be brought to diminish its teaching to make room for new subjects such as supplementary prescribing."

However, there may be practical limitations in the future, for instance two respondents highlighted the limited availability of key ingredients.

### The Place of Extemporaneous Preparation in the Curriculum

Free text responses regarding the status quo of extemporaneous preparation indicated that some viewed it as a "*dying art*", or as a redundant skill:

"Community pharmacists should do nothing but stick a label on a prepacked box/bottle. They should not do any manufacture or re-packing, which should be left the industry who are experts and legally controlled."

"Major employers in community pharmacy discourage extemporaneous dispensing and encourage the use of Specials manufacturers."

In contrast, one respondent considered extemporaneous preparation as fundamental to the identity of pharmacists' as professionals representing:

"...their 'art' or 'craft'. Without it pharmacy is diminished, as extemporaneous dispensing is the outward display of a pharmacist's specialised knowledge."

However, several other respondents stressed the value of extemporaneous preparation teaching lay not in its inherent subject matter but rather that it offered a vehicle to impart key skills defining contemporary professional practice:

"...a useful means of combining practice and science, and a way of exploring students' practical and mathematical abilities."

"It teaches/illustrates many relevant points including dose checking, good working practices, need for documentation, use of reference books, familiarisation with ingredients of products, importance of accuracy in procedures, concept of quality and need for patient confidence in products."

### CONCLUSION

Following the Judicial Judgement in the Peppermint Water case, the RPSGB stated that "all community pharmacists who are going to take on pre-registration trainees need to have an understanding of the basic knowledge and skill levels they are likely to get from a raw graduate" (Pharmaceutical Journal, 1998b).

This paper provides evidence of the nature and extent of the courses in extemporaneous preparation currently offered in UK pharmacy degree programmes. A range of teaching methods is employed—predominantly practical classes and lectures, and students are taught by a range of teaching staff, which in all cases includes registered pharmacists. All students receiving training in the practical aspects of extemporaneous preparation and dispensing, and must demonstrate their competency in a practical assessment.

Currently, only 0.034% of prescription items (i.e. approximately one in 3,000) dispensed in England are prepared extemporaneously in community pharmacies (Department of Health, 2001). This inevitably calls into question the need for pharmacy students to undertake extensive training in what has become largely a redundant skill. This is particularly so given that recent therapeutic advances, such as pharmacogenomics and changes in pharmacists' activities, including prescribing, inevitably means existing subjects within degree programmes must be justified.

The high staff/student ratios, experienced course organisers and extensive assessments indicate that UK schools of pharmacy embrace extemporaneous preparation as an important topic. Moreover, the data from this study suggest that considering the past and future five-year periods, the time devoted to teaching extemporaneous preparation is and will remain relatively constant, with a trend towards a diminution of hours. Moreover, most schools have instituted changes as a result of the Peppermint Water case, which has come to represent a watershed

in pharmacists' training in extemporaneous preparation.

Although extemporaneous dispensing in community and hospital has diminished to almost negligible levels, this study indicates that instruction in this area has considerable additional educational merit, with the development of key skills. Practical exercises in this area provide students with opportunities to perform pharmaceutical calculations, problem-solve, emphasise the importance of accurate and systematic working practices and develop the concept of self-audit.

As a footnote to this study, it should be highlighted that a full response to the questionnaire was achieved from each UK school of pharmacy. In an era of league tables, Research Assessment Exercises and competition for prospective students, it is heartening that such a collegiate spirit exists between those teaching in the same subject area in the different schools.

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