

Development and Design of OSCE in Undergraduate Pharmacy Education in a new School of Pharmacy in England

Abstract

United Kingdom pharmacy practice is being driven by competency-based healthcare practice and the expanding clinical roles of pharmacy practitioners. Setting up a new School of Pharmacy offers the opportunity to design a programme fit for the needs of the future pharmacy workforce. Objective Structured Clinical Examinations (OSCEs) offer the opportunity to assess students in their handling of real life pharmacy practice scenarios, and allow students to develop and hone communication and problem-solving skills. This paper describes the development and design of OSCEs in the undergraduate pharmacy degree at the University of Hertfordshire. The framework of formative and summative OSCEs across the 4-year degree programme is discussed, as are the logistics of setting up and running OSCEs, tutor training, feedback, and reflections on the experience to date and future direction. The OSCEs have been implemented successfully into the undergraduate pharmacy curriculum with positive feedback from staff and students.

Key words

OSCE, pharmacy, assessment, undergraduate education, evaluation

Authors

Beti W Evans

Principal Lecturer

University of Hertfordshire, School of Pharmacy

BPharm, DipClinPharm, MRPharmS

College Lane Campus, Hatfield, HERTS, AL10 9AB, UK

B.W.Evans@herts.ac.uk

Guillaume Alinier

University and National Teaching Fellow (2006)

University of Hertfordshire, School of Health & Emergency Professions and the Learning & Teaching Institute

MPhys, PGCert, CPhys, MInstP, MIPEM, NTF, SFHEA

College Lane Campus, Hatfield, HERTS, AL10 9AB, UK

G.Alinier@herts.ac.uk

Andrzej J Kostrzewski

Academic Manager for Clinical Developments

University of Hertfordshire, School of Pharmacy

MMedEd, Msc, PhD

College Lane Campus, Hatfield, HERTS, AL10 9AB, UK

Tel: +44 (0)1707281051

Fax: +44 (0)1707284506

A.Kostrzewski@herts.ac.uk

Kelly A Leftery

Principal Lecturer

University of Hertfordshire, School of Pharmacy

BPharm(Hons), PGClinDip, Med

College Lane Campus, Hatfield, HERTS, AL10 9AB, UK

K.A.Lefteri@herts.ac.uk

Soraya Dhillon
Head of School and Foundation Professor of Pharmacy
University of Hertfordshire, School of Pharmacy
BPharm (Hons), PhD, FRPharmS, MBE
College Lane Campus, Hatfield, HERTS, AL10 9AB, UK
Tel: +44 (0)1707286107
Fax: +44 (0)1707284506
S.Dhillon@herts.ac.uk

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Introduction

The relatively new School of Pharmacy at the University of Hertfordshire was launched in 2005 and recruited its first students to the four-year undergraduate Master of Pharmacy (MPharm) degree programme in September 2005. The first cohort of students graduated in 2009, after full accreditation of the programme by the Royal Pharmaceutical Society of Great Britain (which has since been superseded by the General Pharmaceutical Council [GPhC]).

The opening of a new school of pharmacy allows for the adoption of innovative learning, teaching, and assessment approaches. While the GPhC sets out graduate outcomes for Schools of Pharmacy in Great Britain¹, there is some freedom to develop a curriculum to match the requirements of tomorrow's pharmacists. In the past decade in the United Kingdom, there has been a drive towards competency based healthcare practice. Government policies such as Agenda for Change² and the Knowledge and Skills Framework³ require health professionals to develop their knowledge, skills and competencies in order to progress their career. The GPhC has also implemented a student code of conduct and fitness to practice procedures to underline the importance of professionalism and to highlight the need to develop professional knowledge and competence^{4,5}. In addition, the establishment of Medical Education England (MEE) and the Modernising Pharmacy Careers (MPC) boards has identified the need for pharmacy education to change in order to meet the needs of practice. MPC is strategically driving forward the agenda for pharmaceutical education to ensure that future pharmacy graduates aspire to the new clinical challenges they face.

To achieve this reform in pharmacy education there is a need to expand and strengthen clinical contextualisation of the MPharm curriculum. The programme developed at the University of Hertfordshire provides a solid platform on which to

build this approach through development of a spiral curriculum.⁶ The MPharm curriculum at the University of Hertfordshire is based on strong science integrated with clinical practice, designed using Miller's pyramid of competence.⁷ That is, students move up the pyramid from demonstrating 'knows', to 'knows how', to 'shows how', and 'does'. The course is delivered through the concept of vertical and horizontal integration of the indicative syllabus. The degree programme utilises a range of learning and teaching approaches, influenced by Kolb and Fry's model of experiential learning, which shows learning as a cyclical process, being formed and re-formed as a result of experience.⁸ A variety of assessment methods is also used, including Objective Structured Clinical Examinations (OSCEs), which are embedded in the modular MPharm programme. OSCEs are used to facilitate the development of students' communication and other key skills, and the application of knowledge, within a simulated and safe environment. Originally developed by Harden *et al*,⁹ an OSCE is usually composed of 15 to 20 exercises^{10,11} through which students rotate individually over a set and equal period of time.

The aim of this article is to describe the development and design of OSCEs in the MPharm programme since the School of Pharmacy was established in 2005.

Developing the initial OSCE

The School of Pharmacy organised a series of workshops to investigate the implementation of OSCEs for the first intake of pharmacy students. The aim of the workshops was to set up the 'Objective Structured Clinical and Pharmaceutical Evaluation' (OSCPE). (Hereon the term OSCPE will be used to refer to the examination used at the University of Hertfordshire School of Pharmacy, and OSCE when this assessment method is discussed in its broader sense.) The workshops were led by one of the University's National Teaching Fellows, who runs the

University's simulation centre, and who had prior experience of OSCEs in nursing¹² and engineering.¹³

During the workshops, academic pharmacy staff members (hereon referred to as tutors), were introduced to the many aspects of OSCEs: their advantages and limitations, their use in relation to module learning outcomes, marking criteria, and to also consider logistics (space and human resources, sequence and duration of exercises). Tutors brainstormed learning outcomes that could be assessed in an OSCPE, and were trained in designing exercises (stations) that could be used in OSCPEs. The learning outcomes determined for OSCPEs are that students should be able to:

- communicate effectively in interaction with patients, carers and other healthcare professionals
- advise patients and other healthcare professionals about medicines and their usage
- interpret and evaluate, for safety, quality, efficacy and economy, prescriptions and other orders for medicines
- undertake structured problem solving
- perform pharmaceutical calculations accurately
- supply medicines in accordance with legal and professional requirements

All these learning outcomes meet GPhC graduate outcomes.¹

Tutors were asked to develop stations, identifying the knowledge and skills tested at each. Stations were based on everyday scenarios from pharmacy practice that met the learning outcomes, and included material covered elsewhere in the module or year of study, such that the students had come across the knowledge content previously. The stations were designed to test a range of skills, including

communication, counselling, history-taking, problem-solving, dispensing, dose conversions, and data retrieval and interpretation. Each station was designed to last a maximum of 5 minutes, during which routine problems can reasonably be expected to be solved. Two types of station were developed: interactive stations, which involve face to face or telephone communication with the examiner who plays the role of a patient/carer or a healthcare professional; and written stations, which involve a short problem or questions such as dosage calculations.

Marking criteria were developed for each station, typically assessing knowledge and, in interactive stations, communication skills. The marking checklist includes up to ten points, which cover elements of knowledge e.g. advice given, and skills such as communication.

Written documents produced for each station include the scenario and bullet list of knowledge and skills tested at the station (for the student); and the examiner's briefing and marking checklist. The examiner's briefing at interactive stations includes information on how the interaction begins, what role they are expected to play, and answers to anticipated questions from students.

During the workshops tutors tested the stations among themselves, and refined the station content and marking criteria as required. Two versions of each station were developed for the first formative OSCPE.

The OSCPE for the first cohort of 51 students was a series of 17 varied interactive and written stations. This number of stations enabled three sessions of the examination to run across three rooms of the simulation centre, which can accommodate up to 20 stations (Figure 1). The simulation centre is a multiprofessional

Intensive Care and Emergency Simulation Centre which also houses a realistic simulated pharmacy.¹⁴

Students undergoing the first two sessions attended an identical OSCPE as they did not have contact with each other in between sessions. Students in the third session encountered stations that varied in detail to the first two sessions but which assessed the same outcomes. This was to reduce any perceived advantage for students undergoing the third session, who may have been given information about the stations by their peers who had already undertaken the assessment.

An automated system was used to time the 5-minute stations, and to allow students 2 minutes to move between stations. Networked monitors countdown the 5-minute time period in each room used in the OSCPE.

Feedback from the initial OSCPE

At the end of the OSCPE, feedback on each station was generated by a de-brief session for tutors. These comments were summarised and made available to students online. A face to face feedback session with students was timetabled for the following academic year, prior to the students' second OSCPE experience.

Reflections from the initial OSCPE are shown in Table 1. It appeared that students who performed well at interactive stations had good communication skills and used a structured approach to a problem. Tutors considered that the OSCPE was an excellent way of testing practical skills. Concerns were raised about tutors getting tired, especially when running consecutive OSCPE sessions over 6 to 7-hour days to assess large cohorts of pharmacy students.

Student feedback on the initial OSCPE was obtained from written reflective accounts, submitted at the end of the module. Four themes of comments were obtained from students which overall were positive towards this form of assessment. Students' found the OSCPE a good way of increasing their confidence and preparing them for future practice. The themes of comments were:

- Learning: "A lot of this knowledge had been gained during dispensing lectures and previous work experience."
- Preparation for the future: "It was useful exercise and it helps us to prepare for working in a pharmacy setting."
- Confidence: "Working under pressure helped me to gain confidence when speaking to patients in real life situations."
- Challenging: "I found the workstations during the OSCPE were much harder and required a lot more relevant clinical knowledge."

The OSCPE framework across all years of study

OSCPEs have now been developed for the four years of the MPharm programme. The OSCPE for year 1 students is formative. Students in years 2-4 attend both a formative and summative OSCPE. The overall learning outcomes across all years are the same, but the knowledge and skills assessed vary and stations increase in complexity. The range of stations developed across years 1 to 4 covers the domains shown in Table 2. The stations build on prior learning, with horizontal and vertical integration of teaching. The framework for the School's OSCPE reflects Miller's pyramid,⁷ the expectation being that by year 4 students' knowledge, communication and problem-solving skills have improved from that seen in year 1.

Each station is taken from practice and mapped into the curriculum's learning outcomes. Legal aspects of prescriptions and dispensing are tested in OSCPEs. At

year 1 this includes emergency supply of prescription only medication. At year 2, formative and summative OSCPEs reinforce the competencies required in dispensing, including managing prescriptions for controlled drugs. Legal aspects of practice such as record keeping, emergency supply and controlled drug regulations are also assessed in the OSCPE in years 3 and 4.

Twenty stations have been developed for each year of study, which is the maximum number of stations that can be housed in the rooms used for this purpose within the simulation centre. Initially two versions of each station were produced (one each for formative and summative assessments), but now at least four versions of stations have been developed.

Validation

Peer review is an essential component of ensuring the validity, reliability, and objectivity of the stations. When a new station is written, up to four different versions are produced and then tested by colleagues in the 5 minutes allowed. If substantial revisions are necessary a second test is undertaken. A limitation of the testing method is that those who test the stations are practitioners who are familiar with the problem and may already know the answer, or are able to locate the answer in the standard reference sources quickly.

Stations may be refined year on year based on tutor feedback and on performance data.

Logistics of organising and running OSCPEs

The key stages in organising and running an OSCPE are summarised in Table 3. The OSCPEs are run in three adjacent rooms within the simulation centre. With 150 students in a year, the 20-station OSCPE requires eight sessions over 3 days, over

which up to three versions of stations are used. Where twenty stations are used, one of these stations is a rest station.

Students are allocated a start station, from which they move on in chronological order to complete the circuit. Interactive stations are separated from other stations using mobile partitions to help students concentrate on their current station only.

Students are given an indication of the themes of the stations beforehand in a briefing document e.g. patient counselling, legal issues. Students and staff are briefed on the day of the examination, to remind both parties of the system, and what is expected of them.

At stations students are presented with scenarios printed onto one side of A4 paper which is either laminated or placed in a plastic wallet. The scenarios instruct the student of what they need to do and tell the students which knowledge and skills are being tested at that station. Students can carry with them a copy of the British National Formulary and Medicines Ethics and Practice guide¹⁵ and a calculator. Other reference material that may be required at some stations is provided at those stations e.g. a Patient information leaflet, dispensed medication or placebo devices.

The number of tutors required at each OSCPE is the sum of interactive stations and at least one other tutor in each of the three rooms to manage the paperwork of the written stations. Tutors and visiting lecturers play the role of patients or healthcare professionals on interactive stations, and also complete the marking sheets (examiner sheets) during the interaction. Other tutors facilitate written stations by collecting completed answer sheets at the end of the 5-minute interval, and by providing a new blank answer sheet for the next student. Written stations are marked

during the examination. The marking criteria at some stations include critical elements (e.g. legal issues).

In the initial OSCPE marks were collated manually. The scale up of student numbers to the maximum intake of 150 per year necessitated automation of the marking process. The School currently uses OSCE software¹⁶ to both produce and scan the optical mark reading (OMR) examiner sheets. The software generates reports including students' performance at each station, total marks for the examination, and analysis of scores at each station. An example of a candidate feedback report is shown in Figure 2.

Tutor training

Staff members across all disciplines are involved in OSCPEs. In terms of training for the original OSCPE, tutors were given access to the station to which they were allocated beforehand to become familiar with its content, the pre-prepared script for interactive stations, and the marking criteria. Prior to first use of the automated system, tutors were trained on the use of the OMR sheets in a dummy examination. Subsequent training of new staff has involved a one to one briefing from an experienced member of staff. On an OSCPE day, where there is changeover of tutors between sessions, tutors liaise to discuss any issues relating to the marking criteria. The OSCE software allows inter-rater comparisons to be made if there are concerns over consistency of marking at a station which has been assessed by more than one tutor.

Feedback mechanisms

At the end of each OSCPE day the tutors meet to reflect on the running of the examination and on students' performance. Tutors' comments on each of the stations are collated to assist in improving the quality of the stations and the assessment.

Students are given group feedback focusing on what was generally done well at each station and what needs improvement via the University's managed virtual learning environment (StudyNet) and/or in lectures. Students are also given individual feedback on their performance at each station relative to their peers using reports generated by the OSCE software (Figure 2).

Student feedback on OSCPEs is obtained via the University's module feedback mechanisms.

Reflections and future developments

From the outset the School of Pharmacy at the University of Hertfordshire was committed to including OSCEs in the curriculum. It is the School's belief that the regular exposure of students to simulated situations such as the OSCPE prepares them to face real practice after qualification and to contextualise their learning. Active learning strategies mimicking actual pharmacy practice have been strongly recommended by the participants of a study conducted by Monaghan *et al.*¹⁷ as well as in other settings.¹²

Formative and summative OSCPEs are utilised throughout the Master of Pharmacy programme as advocated by Monaghan *et al.*¹⁷ OSCEs can provide information on learning deficiencies to both staff and students.^{12,18} The advantage of introducing the OSCPE at year 1 is to establish a goal for students to strive towards in terms of bringing together knowledge, understanding, and application in practice. The formative nature of the OSCPE at year 1 is an invaluable learning tool and helps students become familiar with the assessment process. As found with other studies,^{12,19,20} students are in favour of the use of OSCEs.

The OSCPE is time consuming and requires careful organisation and planning for the session to be successful and valuable.^{12,21,22} Setting up the initial OSCPE in particular was very time consuming. The School's experience to date is that with written protocols for running and organising the assessment the OSCPE days run well. Over the past four years tutors appear to have developed their confidence in both design of the stations and the assessment, facilitated by the development of template documents for writing stations. The introduction of the automated marking of OSCPEs has significantly reduced the academic workload and has enabled the results to be given to students within 48 hours.

A key question on the use of OSCPEs in the curriculum is whether they are an effective and fair assessment method. The School monitors students' performance at OSCPE in relation to their performance across the curriculum. Monitoring of examiner performance is also considered to be important. It has been demonstrated that a single examiner is sufficient to assess the student's performance at a station as long as the marking scheme is concise and objective.^{10,22} Most elements of the marking criteria used at the University of Hertfordshire are objective, although some elements on interactive stations are subjective e.g. communication skills. Examiners are given a guide to follow when a range of marks is available to improve consistency of marking. Some variation between markers is possible, which is monitored using the feedback reports generated by the software.

The School is also keen to provide robust feedback mechanisms, which currently involve a range of methods – group feedback from a tutor, individual reports, and written general tips for what can be improved. The School is considering whether feedback mechanisms need to change with each year of study. A formative OSCPE involving peer-assessment has been piloted for year 4 students. This was well-received and will be extended to year 3.

The number of stations is believed to be an important parameter affecting the reliability and validity of an OSCE.^{10,11,22} The School is investigating whether a 10 station OSCPE is as effective as a 20 station OSCPE, allowing two circuits to be undertaken at the same time. This would halve the time taken for the exam.

Summary

This article describes the development and design of OSCEs in the MPharm curriculum at the University of Hertfordshire. The School set up a 20-station circuit of 5 minute stations that cover a range of practice-based scenarios, which the school calls the OSCPE. The process of setting up the first OSCPE is described, including developing and validating stations, staff training, room and equipment logistics, and tutor and student feedback.

The OSCPE described, which includes a series of interactive and written stations, tests a range of knowledge and skills required in everyday practice, enabling students to integrate their learning. At the University of Hertfordshire, OSCPEs are now used once in the first year as a formative learning opportunity, while in years 2 to 4, formative and summative OSCPEs are delivered. Developments in the process since the first OSCPE include automation of the marking process and changes in delivery of feedback following formative sessions.

The pharmacy undergraduate programme needs to equip students with effective problem solving and communication skills to meet the challenges of the delivery of pharmaceutical services in the UK. OSCPEs are a valuable assessment method to aid development of judgement, professionalism, and clinical competence and knowledge.

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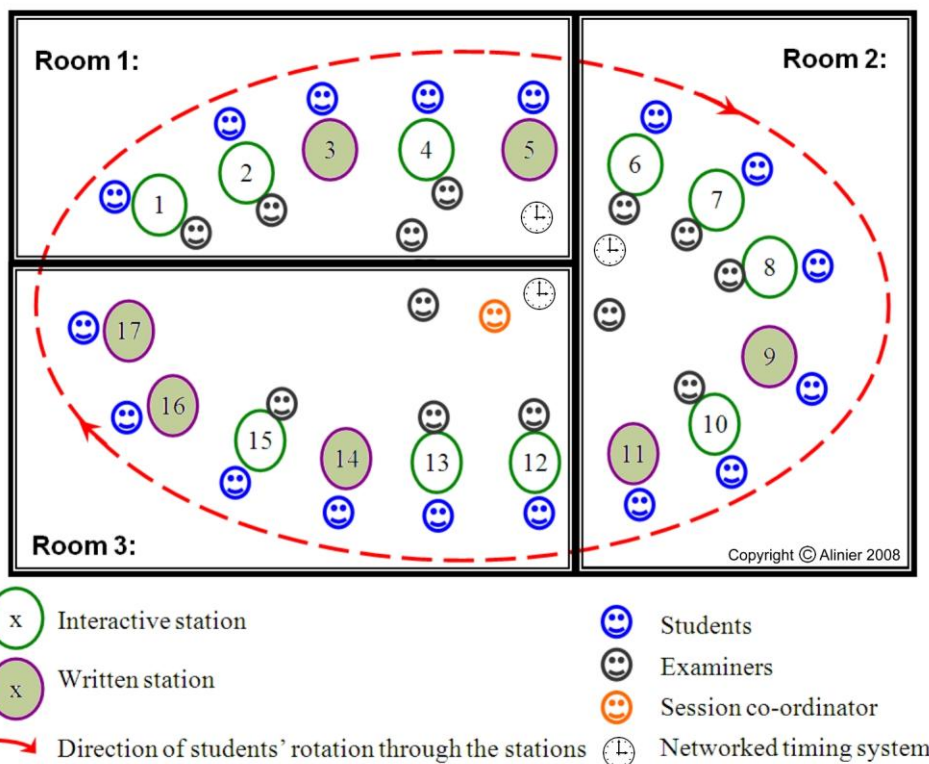


Figure 1: Diagrammatical representation of the 17-station OSCPE.

University of Hertfordshire School of Pharmacy
 Level 4 summative 2008-9
 Candidate Feedback Report

Candidate number : X X X X X X X

This report shows your performance in the examination relative to the other candidates. The symbols in the column headed 'Performance' indicate that you are in
 ↗ the top 25% of candidates.
 → the middle 50% of candidates.
 ↘ the lower 25% of candidates, but not in the bottom 5%.
 ↓ the bottom 5% of candidates.

Your Score	Max Score	Performance	Station
90.00	100.00	→	Response to symptom
90.00	100.00	↗	Emergency supply (B)
70.00	100.00	→	Data retrieval and inter
70.00	100.00	→	Product counselling (B)
80.00	100.00	→	Communication (public
0.00	100.00	→	Controlled drugs (B)
0.00	100.00	→	Rest station
10.00	100.00	→	Therapeutic drug moni
80.00	100.00	↗	Dose conversion (B)
70.00	100.00	→	Device counselling (B)
50.00	100.00	→	Prescription managem
30.00	100.00	→	Drug administration (B)
70.00	100.00	→	Communication (medi
0.00	100.00	↘	Checking dispensed m
70.00	100.00	→	Breastfeeding (B)
90.00	100.00	↗	Interpreting laboratory
90.00	100.00	↗	Dispensing errors (B)
60.00	100.00	→	General enquiry (B)
100.00	100.00	↗	Dose calculation (B)
40.00	100.00	→	Choice of treatment (B)
61.05	100.00	→	TOTAL

Figure 2: Candidate feedback report

STUDENT GENERAL PERFORMANCE

POSITIVE	NEGATIVE
<ul style="list-style-type: none"> Professional attitude Excellent communication skills Checking for understanding and clarity Structured approach to consultation 	<ul style="list-style-type: none"> Poor eye contact Poor expression and explanation No check for understanding Poor structured approach to consultation
OSCOPE PROCESS	
POSITIVE	NEGATIVE
<ul style="list-style-type: none"> Excellent set up and smooth running Good variety of stations covering OTC consultation, prescription legal issues, drug interactions Enables testing of skills Develops interpersonal and excellent communication skills 	<ul style="list-style-type: none"> Students do not receive immediate feedback Stations need to be tested; some too complex for time scale Tiring for examiners

Table 1: Tutors' comments on students' general performance and process of the OSCPE

Year 1	Year 2	Year 3	Year 4
Responding to symptoms	Responding to symptoms	Responding to symptoms	Responding to symptoms
Telephone communication with prescriber – inappropriate prescription	Telephone communication with prescriber – inappropriate prescription	Telephone communication with prescriber – inappropriate prescription	Telephone communication with prescriber – inappropriate prescription
Record keeping involving emergency supply*	Record keeping involving emergency supply and controlled drugs	Record keeping involving emergency supply and/or controlled drugs	Record keeping involving emergency supply and/or controlled drugs
Counselling prescription medications including devices	Counselling prescription medications including devices	Counselling prescription medications including devices	Counselling prescription medications including devices
Dose calculations/conversions	Dose calculations/conversions	Dose calculations/conversions	Dose calculations/conversions
Data retrieval and interpretation e.g. drug interactions	Data retrieval and interpretation	Data retrieval and interpretation e.g. identification of foreign drugs	Data retrieval and interpretation e.g. dosage for impaired renal

			function
		Provision of general health advice	Provision of general health advice
		Problem solving e.g. therapeutic drug monitoring	Problem solving e.g. changing medication based on laboratory data

*legal issues of dispensing may also appear in any other stations e.g. a prescription not signed or is out of date

Table 2: The range of stations included in the OSCPE in each year of study

Stage of OSCPE organisation	Approximate time taken
Set dates, book rooms	1 hour
Organise tutors to help on days of OSCPE	2 hours
Train new tutors	Up to 1 hour each
Finalise stations – check details from last year, amend if necessary. Print and put copies of stations in plastic wallets or laminate. Print or prepare supporting material e.g. labelled containers of medicines, Summaries of Product Characteristics (SPCs)	21-35 hours
Finalise tutor and student briefings	1 hour
Set up OSCPE exam on software	1-2 hours
Print off examiner sheets for each session of each exam	5-7 hours
Set up rooms in required format – tables, chairs, partitions	1 hour
Run exam over required number of days	For a 150 cohort, 8 sessions of 140 minutes; 17-18 hours (3 sessions on each of 2 days, 2 sessions on 1 day)
Mark examiner sheets using scanner	3 hours
Print off reports, prepare written summary of feedback	1 hour

Table 3: Key stages in OSCPE organisation for 150 students