SCHOOL OF PHARMACY

The Impact of the Flipped Classroom Instructional Model on MPharm Students in Two Pharmacy Schools in the UK

This thesis is submitted in accordance with the requirements of University College London for the degree of Doctor of Philosophy by

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January 2018

Plagiarism Statement

This thesis describes research conducted at the UCL School of Pharmacy between 2013 and 2017 under the supervision of Professor Jane Portlock and Dr Angel Chater. I certify that the research described is original and that any parts of the work that have been conducted by collaboration are clearly indicated. I also certify that I have written all the text herein and have clearly indicated by suitable citation any part of this thesis that has already been published.

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Signature Date

This thesis is dedicated to
My beloved parents who have always been there for me
My best friend, Dalia, who encouraged me to go on this adventure
My wonderful brother, Ali, who has a special place in my heart

Acknowledgements

First and foremost, I would like to thank God for giving me the strength and patience to complete this work.

Sincere gratitude and appreciation is extended to my supervisors, Professor Jane Portlock and Dr Angel Chater, for their invaluable guidance, and encouragement. I am very much grateful for their support throughout the PhD journey, which helped me to build my skills and competence as a researcher.

Many thanks go to Professor Felicity Smith, and Professor David Taylor for their valuable input in my upgrade Viva.

I would also like to express my deepest gratitude to the E-learning coordinator at UCL School of Pharmacy, Mr Adam Phillips, for his great support with creating the online learning materials for this research.

I would like to acknowledge with great appreciation all the academics in the Pharmacy Practice Department, at UCL School of Pharmacy and the School of Pharmacy and Biomedical Sciences at University of Portsmouth, who collaborated with me to conduct this research. Particularly, I would like to thank Mrs Louise Brown, Mr Nick Warren, Ms Maaya Modha, Mr Zachariah Nazar, and Ms Nadia Bukhari.

Sincere thanks go to all MPharm students who took part in this research project. Without their participation, completing this study would not be possible.

Many appreciations also go to the UCL Arena Centre for Research-based Education for offering me the opportunity to join the Teaching Associate Programme (TAP), which helped me to develop my core knowledge in various areas of teaching and learning.

I am very much grateful to Dr Li Wei, the senior lecturer of epidemiology and medical statistics at UCL School of Pharmacy, for her help and advice with the quantitative data analysis.

I am deeply indebted to my best friend, Dalia Almaghaslah, for her generous and unconditional support throughout the way and beyond.

My colleagues and friends in the Research Department of Practice and Policy, thank you very much for being a lovely, supportive, and caring family. Special gratitude and appreciations must go to Naoko Arakawa, Dalal Alsaeed, Zahra Alsairafi, Eneyi Kpokiri, Mai Almanea and Asma'a Alhaqan, for their effort in lending a listening ear especially during the write-up stage.

My lovely family: thank you very much for your support, prayers, and endless love. Mom and Dad: I am very much grateful for your 'every day phone call' making sure I was OK. My little brother, Ali: your inspirational words meant a lot to me.

Finally, I would like to thank the Ministry of Higher Education in Saudi Arabia for funding my research.

Abstract

Introduction: A “flipped classroom” uses technology to shift the traditional lecture outside the scheduled class time and uses the face-to-face time to engage students in interactive activities.

Aim of the study: Assess the feasibility, acceptability and effectiveness of using the “flipped classroom” teaching format with MPharm students in two pharmacy schools in the UK: UCL School of Pharmacy and the School of Pharmacy and Biomedical Sciences at University of Portsmouth.

Methods: An experimental mixed methods design was employed, with final year MPharm students in two phases; 1) a qualitative study using focus groups 2) a quasi-experiment measuring knowledge acquisition and satisfaction by delivering a session on rheumatoid arthritis, in two teaching formats: the flipped classroom and the traditional lecture.

Results: The flipped classroom approach was preferred over the traditional lecture for delivering a pharmacy practice topic, and it was comparable or better than the traditional lecture with respect to knowledge acquisition. In addition, this teaching approach was found to overcome the perceived challenges of the traditional lecture method such as fast pace instructions, student disengagement and boredom due to lack of activities and/ or social anxiety. However, high workload and difficult or new concepts could be barriers to pre-class preparation, and therefore successful flipped classroom. The flipped classroom encouraged learning scaffolding where students could benefit from application of knowledge, and interaction with peers and the lecturer, which might in turn facilitate learning consolidation and deep understanding. This research indicated that the flipped classroom was beneficial for all learning styles.

Conclusion: Implementing the flipped classroom at both pharmacy institutions was successful and well received by final year MPharm students. Given the attention now being put on the Teaching Excellence Framework (TEF), understanding effective methods of teaching to enhance student achievement and satisfaction is now more valuable than ever.

Impact Statement

The traditional lecture has long been the norm in university teaching settings worldwide. Class time is usually spent on delivering the knowledge-based content of the curriculum rather than engaging students in interactive learning.

MPharm graduates in the UK are expected to show a range of pharmacy-related cognitive and practical skills and a range of transferable skills such as the independent learning ability that is necessary for the continuing professional development. Pharmacy practice has moved away from focusing on products towards a more patient-oriented emphasis. Higher education is expected to produce active, self-directed, lifelong learners with critical thinking and problem-solving skills. These skills may be better developed by employing active learning and other high-level teaching approaches.

This research extends the current knowledge of the impact of the flipped classroom to undergraduate pharmacy students and it suggests evidence-based recommendations that might be valuable for successful flipped classroom implementation. The key strengths of this research are its mixed methods design, which allowed for a deeper understanding of MPharm students' perceptions and experiences and it is the first in the UK to investigate the flipped classroom in the context of pharmacy education. This study has shown that the flipped classroom teaching method was preferred over the traditional lecture for teaching a pharmacy practice topic. The second major finding was that the flipped classroom pedagogy could potentially overcome the perceived challenges of the traditional lecture method including fast pace and lack of student involvement. In addition, learning scaffolding encouraged by the flipped classroom method might assist in adopting a deeper approach to learning, which is not normally achieved in the traditional lecture.

It seems from this study that implementing the flipped classroom in MPharm programmes considering the practical recommendations suggested by this research could possibly improve the National Student Survey (NSS) results relating to teaching on the course. Accordingly, raising the Teaching Excellence Framework (TEF) performance for the institution, which is heavily dependent on NSS data. This research will also serve as a basis for future studies since it has thrown up many questions that require further investigation both locally and internationally.

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Abbreviations

ACPE	Accreditation Council for Pharmacy Education
ASHP	American Society of Health-System Pharmacists
CPD	Continuing Professional Development
CUCEI	The College and University Classroom Environment Inventory
GPA	Grade Point Average
GPhC	General Pharmaceutical Council
IPA	Interpretative Phenomenological Analysis
LSI	Learning Style Inventory
MPharm	Master of Pharmacy
NSS	National Student Survey
OSCE	Objective Structured Clinical Examinations
PharmD	Doctor of Pharmacy
POGIL	Process oriented guided inquiry learning
TEF	Teaching Excellence Framework
UCL	University College London
UK	United Kingdom
UOP	University of Portsmouth
US	United States of America

Preface

A “flipped classroom” is one of the innovative approaches to teaching that utilises technology to shift the traditional lecture outside the scheduled class time and uses the face-to-face time to engage students in interactive activities.

This research set out to assess the feasibility, acceptability and effectiveness of the “flipped classroom” teaching format on MPharm students in two pharmacy schools in the UK: UCL School of Pharmacy and the School of Pharmacy and Biomedical Sciences at the University of Portsmouth. The specific objectives were (1) to determine the impact of the flipped classroom teaching model on students’ knowledge acquisition; (2) to evaluate students’ satisfaction with and attitudes towards the flipped classroom instructional model; (3) to document the challenges linked to implementation of the flipped classroom; and (4) to ascertain ways to improve implementation of the flipped classroom teaching method.

The traditional lecture has been the main instructional approach in higher education institutions globally (Love et al., 2013). Class time is generally spent on delivering the content of the curriculum rather than engaging students in active learning exercises (Gannod et al., 2008). Active learning is described as an approach to teaching that requires students to actively participate in classroom activities that have been designed by educators (Gleason et al., 2011). Active learning is believed to be a path to improve learners’ motivation, performance and attitude. It is also linked to improved higher-order thinking, critical analysis and problem-solving skills (Gannod et al., 2008; McLaughlin et al., 2013; Moravec et al., 2010).

Pharmacy practice has shifted away from product-oriented focus, to patient-oriented emphasis (Gleason et al., 2011). The General Pharmaceutical Council (GPhC), the authority responsible for setting out standards for pharmacy education and training in the UK, states clearly that “a curriculum should not be formulaic and should include a variety of teaching and learning

methods that result in learning that integrates theory and practice for developing the skills students need to become self-directed learners" (GPhC, 2011, p. 43).

The flipped classroom innovative approach shows promising results in terms of students' satisfaction and academic achievement. In some studies, however, students found this method burdensome and were dissatisfied. Others found it difficult to link the two phases of the flipped model. This teaching approach has been gaining popularity in various levels of academic institutions, but it seems that there is a paucity of research offering in-depth understanding of this teaching method and therefore recommendations for successful implementation.

The literature did not reveal any published studies that examined the flipped classroom instructional model in pharmacy education in the UK. Thus, this study was developed to provide a deep understanding of the impact of the flipped classroom in the context of pharmacy education. This research had a mixed methods design and it was conducted in two separate stages. The findings of this research enabled strategies to be recommended for implementing a flipped classroom based on a theoretical perspective.

An overview of the thesis

This thesis is divided into nine chapters. Chapter one, introduction, provides an overview of adult learning and describes in detail the six principles of Knowles' andragogy and learning taxonomies. In addition, it provides an overview of teaching and learning in higher education, quality assurance in higher education in the UK, pharmacy as a healthcare profession, pharmacy education in the UK, and mechanisms for improving students' learning experience in undergraduate higher education in the UK.

Chapter two, the flipped classroom instructional model in higher education, provides a review of the literature on implementing the flipped classroom teaching approach in higher education institutions.

Chapter three, methodology, starts by summarising the preliminary fieldwork that was undertaken in the early stages of this research programme. It also presents the research paradigm, the study design and the rationale for the chosen method, the study setting and participants, the procedures of data protection and ethical considerations, methods for data processing and analysis, and finally it discusses the validity and reliability of the research.

Chapter four, stage I –method, describes the methods employed to meet the aims and objectives of the first stage of this research, which was a qualitative study using a focus group approach.

Chapter five, stage I –results and discussion, presents qualitative results, from two focus groups, under six overarching themes. It then discusses the findings in the context of current literature.

Chapter six, stage II –method, presents the methods employed to meet the aims and objectives of the second stage of this research, which was a quasi-experimental, mixed methods study. It also outlines the findings from stage I that have informed this stage.

Chapter seven, stage II –results and discussion, starts by presenting the findings from the quantitative phase and then the qualitative phase. It then discusses the findings in the context of current research.

Chapter eight, overall discussion of the thesis, integrates findings from stage I and II and discusses them in the context of pharmacy education and adult literature. It also highlights the reflexivity of the research, trustworthiness of the findings, limitations of the research and recommendations for future work.

Chapter nine, conclusion, presents how this research has achieved the aims and objectives of the thesis.

The researcher's background

I am a Saudi national; I speak English as a second language but Arabic is my mother tongue. I undertook my first degree in pharmaceutical sciences at King Saud University in Saudi Arabia. I graduated in 2009 with a second-class honours degree. As an undergraduate pharmacy student, my grade point average (GPA) had enabled me to undertake training in a number of prestigious hospitals that offer advanced pharmacy services. My experience as a trainee was overwhelming and I felt that my skills were not good enough to practise pharmacy and provide clinical pharmacy services. For that reason, I decided to undertake a master's degree in Clinical Pharmacy, International Practice and Policy at UCL School of Pharmacy to further improve my skills. Being exposed to active learning methods during this programme and being involved in a research assignment on active learning methods made me reflect on my own learning experience as an undergraduate pharmacy student. In addition, I realised that spoon-feeding through traditional lectures and lack of active learning exposure resulted in my poor preparedness for the workplace. This in turn stimulated my interest to undertake further research in pharmacy education and develop the teaching practice in my home country. I have the desire to occupy an academic position in one of the pharmacy institutions in Saudi Arabia and take the lead in advancing pharmacy education by teaching academics how to teach, and also by implementing and assessing new teaching and learning strategies. Conducting this research in the UK enabled me to develop as a researcher and also gain experience from participating in different activities related to teaching and learning. Shortly after I started my PhD at UCL School of Pharmacy, I was engaged as a demonstrator and assessor for MPharm OSCEs, both formative and summative. In addition, I took part in the UCL Arena One Teaching Associate Programme that allowed me to familiarise myself with and learn about theoretical concepts of teaching and learning. As it is my intention to apply what I have learnt from this journey in my next role, I thought it was valuable to discuss the implications of this research, which was based on a UK population, in the Saudi Arabian context.

Chapter 1 Introduction

This introductory chapter begins by providing an overview of adult learning and describes in greater detail the six principles of Knowles' andragogy. The next section explains two learning taxonomies: Bloom's and the SOLO. It then goes on to provide a brief overview of teaching and learning in higher education, quality assurance in higher education in the UK, pharmacy as a healthcare profession, and pharmacy education in the UK. The final section of this chapter covers the mechanisms for improving students' learning experience in undergraduate higher education in the UK.

1.1 Adult learning

Education is an action employed by one or more agents that is intended to produce changes in knowledge, skills and attitudes of learners. Learning, however, is the act or process that leads the person to acquire behavioural change, knowledge, skills and attitudes (Knowles et al., 2012).

Adults' learning opportunities can be found in various settings such as academic institutions and their home or workplace. Understanding adults' learning opportunities is important for two reasons. Firstly, acknowledging learners' prior knowledge and experiences is significant to adult educators' practice. Secondly, making not only the formal adult education obvious will allow individual learners, even those without formal schooling, to better identify their abilities and skills as lifelong learners (Merriam et al., 2007).

In the early decades of the twentieth century, adult learning was given sporadic attention. However, in the 1970s adult educators started focusing on its unique characteristics. Similar to human learning in general, no single theory has been developed to explain adult learning. Instead, adult learning is described in a number of theories, frameworks, and models (Merriam et al., 2007).

1.1.1 Andragogy

Knowles' andragogy (1980; 1989) is considered the best-known theory that explains adult learning. It is a set of assumptions that can be used by both learners and educators to strengthen the learning process (Merriam et al., 2007). It is worth noting that the number of andragogical assumptions has increased from four to six over the years since Knowles updated his work in 1989. Thus, Knowles' andragogy is presented in literature in different ways depending on which version of his work is consulted. The six core andragogical principles are: (1) the learner's need to know, (2) self-directed learning, (3) prior experience of the learner, (4) readiness to learn, (5) orientation to learning and problem solving, and (6) motivation to learn (Knowles et al., 2012).

Knowles, Holton and Swanson (2012) assert that andragogy offers core principles of adult learning that enable educators to build more effective learning processes for adult learners. In addition, it is applicable to any adult learning situation, from community education to continuing professional development (CPD). However, it works best in practice when the individual differences and the learning situation are taken into consideration. Refer to Figure 1.1 for the andragogy in practice model proposed by Knowles and colleagues in 1998.

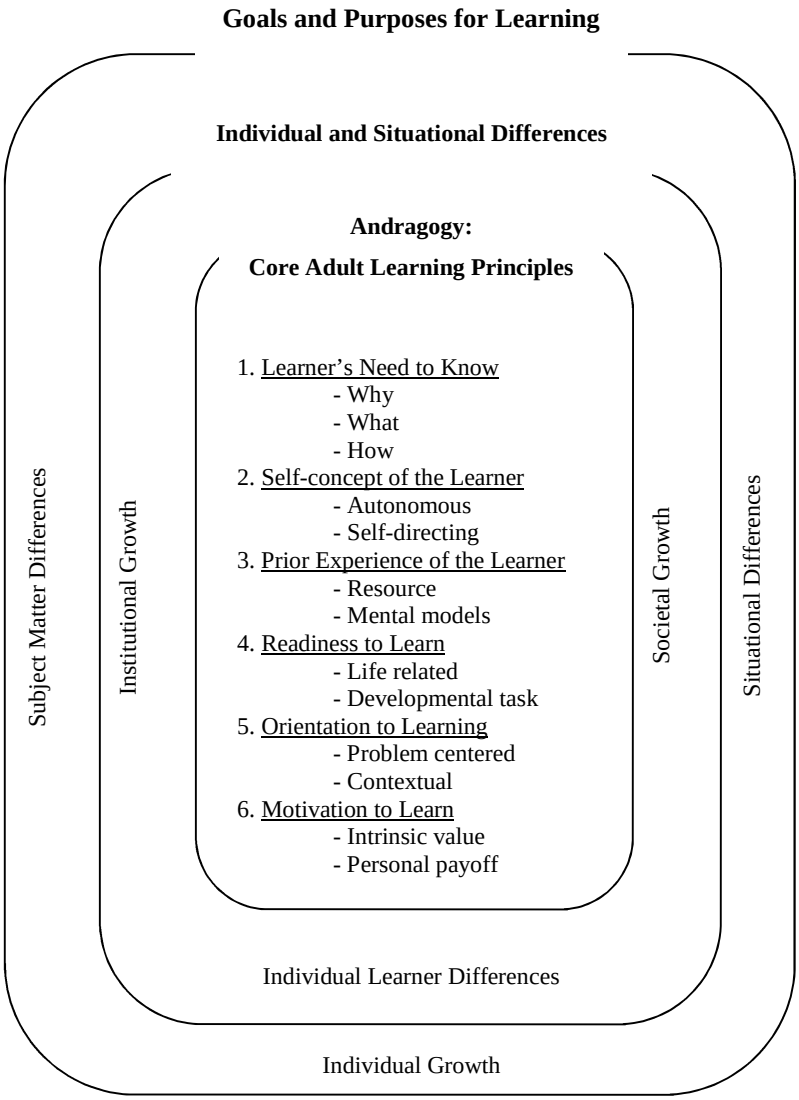

Figure 1.1: Andragogy in Practice Model (Adapted from Knowles et al., 2012, p. 4)

1.1.1.1 The learner's need to know

This core concept of andragogy has led to the idea that supports the engagement of adults in mutual planning for the learning process. It is believed that mutual control over the learning strategies is correlated with more effective learning. Adults become more satisfied with respect to their need to know and their self-concept as independent learners when they are engaged as collaborative partners for learning. In particular, the adult learner

needs to know how the learning will be conducted, what learning will occur, and why that learning is valuable (Knowles et al., 2012).

1.1.1.2 Self-directed learning

Self – directed learning is one of the most extensively researched areas in adult education. Building personal autonomy is thought to be the most important aspect of self-directed learning. Adult learners may show different capabilities and preferences in a particular learning situation (Knowles et al., 2012). Grow (1991) believes that self-directed learning is situational and learners move through stages of greater self-direction. The responsibility of the teacher is to match the learner's stage of self-direction and assist the student to shift towards better self-direction (Grow, 1991). Refer to Table 1.1 for Grow's (1991) staged self-directed learning model. Knowles et al. (2012) stress that having a learner in a particular stage of Grow's (1991) model could be related to self-teaching skills, or personal autonomy, or both. Application of the staged self-directed model is illustrated in Figure 1.2.

Knowles et al. (2012) claimed that the contingency model of self-directness closely matches the reality of most learning situations. Thus, this model appears most applicable for facilitators of adult learning. There are a number of factors an adult learner considers when choosing whether to behave in a self-directed manner at a particular point. These could include locus of control, previous experience with the subject, efficiency, social orientation and previous learning socialisation. Thus, adult learners have a self-concept of being independent. In other words, having a sense of personal autonomy and being able to choose the learning strategy is critical for adults, but self-teaching is not (Knowles et al., 2012).

Table 1.1: The Staged Self-directed Learning Model (Adapted from Grow, 1991, p. 129)

Stage	Student	Teacher	Examples
Stage 1	Dependent	Authority, coach	Coaching with immediate feedback, drill. Informational lecture. Overcoming deficiencies and resistance.
Stage 2	Interested	Motivator, guide	Inspiring lecture plus guided discussion. Goal-setting and learning strategies.
Stage 3	Involved	Facilitator	Discussion facilitated by teacher who participates as equal. Seminar. Group projects.
Stage 4	Self-directed	Consultant, delegator	Internship, dissertation, individual work or self-directed study group.

S4: Self-directed learner			Independent projects. Student-directed discussions. Discovery learning. Instructor as expert, consultant and monitor.	
S3: Involved learner		Application of material. Facilitated discussion. Teams working closely with instructor on real problems. Critical thinking. Learning strategies.		
S2: Interested learner	Intermediate material. Lecture-discussion. Applying the basics in a stimulating way. Instructor as motivator.			
S1: Dependent learner	Introductory material. Lecture. Drill. Immediate correction.			
	T1: Authority, expert	T2: Salesperson, motivator	T3: Facilitator	T4: Delegator

Figure 1.2: Applying the Staged Self-direction Model to a Course (Adapted from Grow, 1991, p. 143).

1.1.1.3 Prior experiences of the learner

The learning process is greatly affected by the past experience of the adult learner (Knowles et al., 2012). This dimension of learning involves linking the current situation to what was learnt in the past as well as to potential future experiences (Merriam et al., 2007). In fact, prior experience can assist in the learning process only if the adult learner can relate the new knowledge to the existing knowledge and experiences. However, experience can be a hindrance to the learning process when the new learning challenges the prior experience. Thus, the unlearning process is considered to be as critical as the learning process when the previous experience is significantly confronted by the new learning (Knowles et al., 2012).

Schon (1987) has written about ‘Knowing-in-action’ and ‘Reflection-in-action’. He explains *Knowing-in-action* as the automatic responses linked to an

individual's exiting mental schema that enables efficient performance in daily actions. In contrast, *Reflection-in-action* is the process that involves reflecting while carrying out an activity to discover when present schema no longer fit the situation, and making changes to those schema when appropriate.

Similarly, Argyris (1982) described two contrasting concepts of learning, single-loop and double-loop learning. Single-loop learning is concerned with learning that fits the prior experiences and values of the learner and leads to an automatic response. On the other hand, double-loop learning is learning that does not fit the learner's prior experience and necessitates a change in the mental model. Knowles and colleagues (2012) point out that reflection-in-action and double-loop learning feature the most effective learners and practitioners.

Based on the information-processing theory (Huber, 1993), prior knowledge of the learner can filter learning through an intentional process. In other words, learners are more attentive to learning that fits with their prior knowledge schema. In contrast, learners are likely to pay less attention to learning that does not fit (Knowles et al., 2012).

1.1.1.4 Readiness to learn

Knowles, Holton and Swanson (2012) claim that adults normally become ready to learn when their life situations generate a necessity to know. Anticipating and understanding adults' life situations and readiness for learning allows adult learning professionals to become more effective. Considering that learning experiences are highly situational and the behaviour of the learner differs with the learning situation, Pratt (1988) proposes a four-quadrant model of high and low direction and support (Figure 1.3). This model shows how life situations affect both readiness to learn and readiness for andragogical-type learning experiences. In each learning situation, adult learners exhibit variations in two core dimensions: direction and support. Direction is concerned with the need for assistance in the learning process; whereas support is concerned with the need for emotional encouragement in the learner's commitment to the learning

process and/or in the learner's confidence about their learning ability (Knowles et al., 2012).

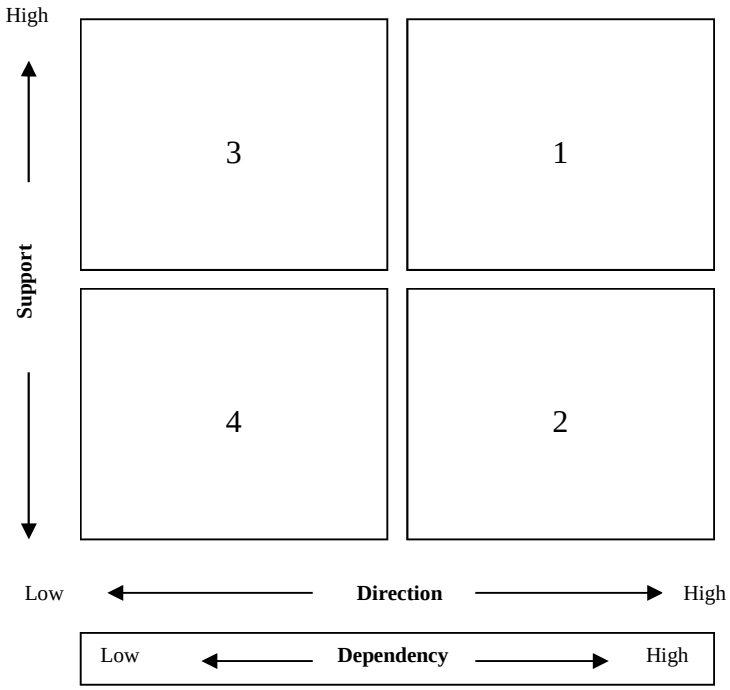

Figure 1.3: Pratt's Model of High and Low Direction and Support (adapted from Knowles et al., 2012; Pratt, 1988)

1.1.1.5 Orientation to learning and problem solving

The role of current experiences is closely linked to the role of previous experiences in influencing the need to learn. Generally, adults have a preference for a problem-solving orientation to learning over subject-centred learning. Additionally, adult learning is facilitated by presenting information in a real-life context. Therefore, the experiential method to learning has become popular in adult learning practice (Knowles et al., 2012).

Experiential learning theory was developed by David A. Kolb, and it builds on the work of prominent scholars who gave experience a weight in their theories of human learning and development. Examples of such scholars are John Dewey, Kurt Lewin, Jean Piaget, William James and Lev Vygotsky (Kolb and Kolb, 2005a; Kolb, 2014). Experiential learning theory defines learning as *"the process whereby knowledge is created through the*

transformation of experience", and knowledge "*results from the combination of grasping and transforming experience"* (Kolb, 2014, p. 51). The model of experiential learning theory (Figure 1.4) describes two dialectically related modes of grasping experience, which are concrete experience and abstract conceptualisation, and two dialectically related modes for transforming experience named reflective observation and active experimentation (Kolb and Kolb, 2005a; Kolb, 2014).

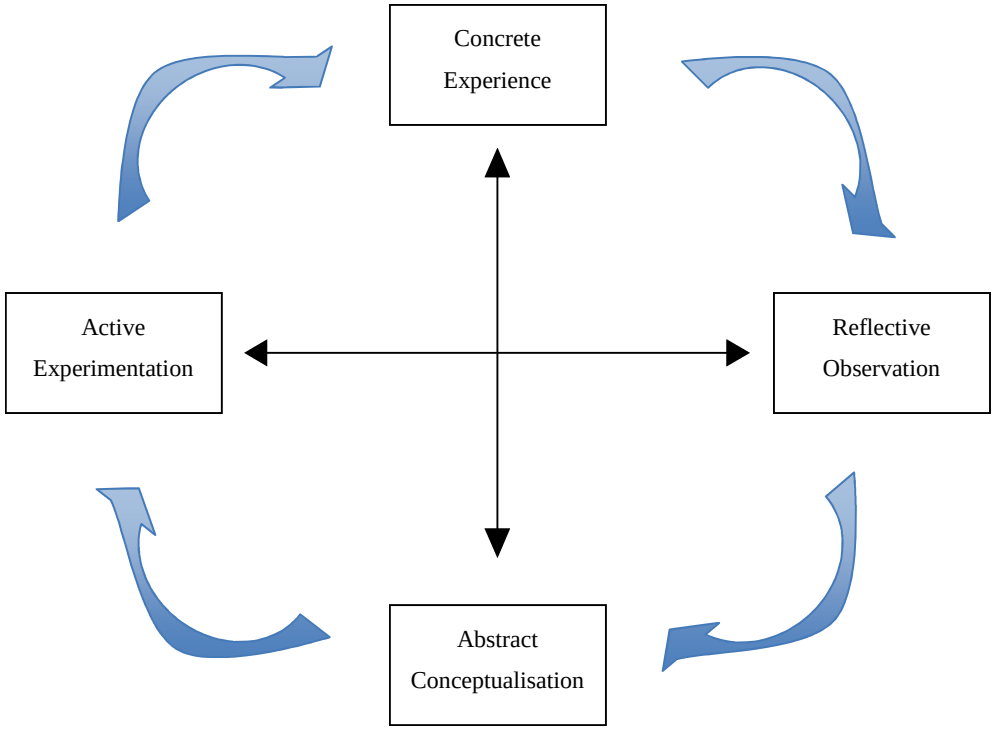

Figure 1.4: Kolb's Experiential Learning Model (Adapted from Kolb, 2014, p. 51)

Learning occurs as a result of the resolution of creative conflict among the four learning modes. Thus, effective learners must be able to execute all four stages of the experiential learning model – experiencing, reflecting, thinking, and acting – in a recursive process that is sensitive to the learning situation and what is being learned (Kolb and Kolb, 2005a; Kolb, 2014). Table 1.2

shows learning modes and their particular learning abilities in experiential learning.

Table 1.2: Learning Modes and their Particular Learning Abilities in Experiential Learning

Learning mode	Explanation
Concrete experience	Ability to be involved fully, openly and without bias in new experiences
Reflective observation	Reflection on and observation of the learner's experiences from many perspectives
Abstract conceptualisation	Creation of concepts that integrate the learner's observations into logically sound theories
Active experimentation	Using these theories to make decisions and solve problems

(Source: Kolb, 2014, p. 42)

The experiential learning theory serves as an invaluable framework for designing learning experiences for adults. For instance, higher education programmes can be structured to include the four components of the experiential learning model. In addition, these components can be included in the curriculum as units or lessons. Table 1.3 shows examples of learning strategies that correspond with each stage of Kolb's experiential learning cycle (Knowles et al., 2012).

Table 1.3: Kolb's Model with Suggested Learning Strategies

Kolb's Stage	Example Learning/Teaching Strategy
Concrete Experience	Simulation, Case study, Field trip, Real experience, Demonstrations
Reflective Observation	Discussion, Small groups
Abstract Conceptualisation	Sharing content
Active Experimentation	Laboratory experiences, Internship, Practice sessions

(Source: Knowles et al., 2012, p. 197)

Based on the experiential learning theory, Kolb has created the learning style inventory (LSI) that measures four learning styles: converging, diverging, accommodating and assimilating. Each learning style combines the preferred mode from both grasping and transforming experience. Refer to Table 1.4 for the description of Kolb's learning styles (Kolb and Kolb, 2005a; Kolb, 2014).

Table 1.4: Description of Kolb's Learning Styles

Learning Style	Dominant Learning Abilities	General Characteristics	Preferred Learning Environments
Diverging	Concrete experience and Reflective observation	Best at viewing concrete situations from many different points of view, have broad cultural interest and like to gather information Interested in people and tend to be imaginative and emotional.	Prefer to work in groups, to listen with an open mind and to receive personalised feedback.
Assimilating	Abstract conceptualisation and Reflective observation	Best at understanding a wide range of information and putting it into concise, logical form. Less focused on people and more interested in ideas and abstract concepts, find it more important that a theory has a logical soundness than a practical value.	Prefer reading, lectures, exploring analytical models and having time to think things through.
Converging	Abstract conceptualisation and Active experimentation	Best at finding practical uses for ideas and theories, have the ability to solve problems and make decisions based on finding solutions to questions or problems, prefer to deal with technical tasks and problems rather than with social and interpersonal issues.	Prefer to experiment with new ideas, simulations, laboratory assignments and practical applications.
Accommodating	Concrete experience and Active experimentation	Have the ability to learn from primarily ‘hands-on’ experience, enjoy carrying out plans and being involved in new and challenging experiences, tend to act on ‘gut’ feelings rather than on logical analysis, rely more heavily on people for information rather than on their own technical analysis.	Prefer to work with others to get assignments done, to set goals, to do field work and to test out different approaches to completing a project.

(Source: Kolb and Kolb, 2005, pp. 196-197)

1.1.1.6 Motivation to learn

Adults lean towards being more motivated in learning that results in internal need satisfaction or helps them solve problems in their lives. Compared to external payoffs such as salary rises, internal payoffs are more effective motivators to learning (Knowles et al., 2012). Wlodkowski (1985) believes that adult motivation operates on three integrated levels. The most critical and basic level of positive adult motivation for learning is success and volition. In other words, adult learners want to feel a sense of choice along with their success in the learning activity for their motivation to be sustained. The second level is a sum of success, volition and value. This means that the adult learner perceives the learning activity as meaningful and worthwhile, but not necessarily pleasurable, and tries to achieve the intended benefits from it. The last level of positive motivation in adult learning involves enjoyment in addition to success, volition and value.

In summary, adult learning models presented earlier can be invaluable in understanding how adults learn and therefore in designing effective learning processes in the context of undergraduate education. However, it is extremely important to consider individual and situational differences when applying the principles of Knowles' andragogy as these can influence the learning process.

In the context of undergraduate pharmacy education, for instance, students who are in early years of the programme may not behave in a self-directed manner and therefore they might need high direction and support compared to their later years on the programme. Similarly, senior pharmacy students might exhibit a low level of confidence in their self-directed learning capability when exposed to an unfamiliar learning situation or subject matter. Thus, taking into account individual and situational differences is key when assessing the extent to which these variations would impact on each of the six andragogical assumptions.

1.2 Learning taxonomies

Learning taxonomies are typically used to describe different types of learning behaviours. They are often used to define and distinguish different levels of learning development. Thus, they are useful tools in guiding the development of course curriculum, teaching methods and assessment (O'Niell and Murphy, 2010).

1.2.1 Bloom's Taxonomy

Bloom's taxonomy classifies cognitive skills into six categories ranging from lower-order skills that involve less cognitive processing to higher-order skills that require deeper learning and a greater level of cognitive processing (Figure 1.5) (Adams, 2015; Anderson and Sosniak, 1994; Bloom, 1956).

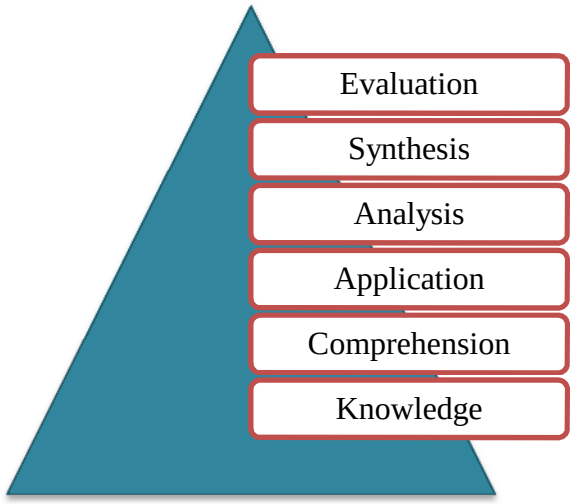

Figure 1.5: Bloom's Taxonomy

Bloom's cognitive taxonomy was revised in 2011 by Anderson and Krathwohl. In their revision, Bloom's original levels were substituted with remember, understand, apply, analyse, evaluate and create (Anderson and Krathwohl, 2001). Thus, the revised version places the skill of synthesis rather than evaluation at the top level of the hierarchy (Adams, 2015). In addition, it puts emphasis on the knowledge dimension that is indicated in Bloom's original work and classifies knowledge into the following categories:

factual (terminology and discrete facts), conceptual (categories, theories, principles and models), and procedural (knowledge of a technique, process or methodology). The updated version also added ‘metacognitive’ to the existing knowledge categories. It involves self-assessment ability and knowledge of various learning skills and techniques (Adams, 2015; Anderson and Krathwohl, 2001).

1.2.2 The SOLO Taxonomy

The SOLO taxonomy is a model of learning developed by John B. Biggs and Kevin F. Collis in 1982. SOLO stands for structure of the observed learning outcome, and it describes levels of increasing complexity in a student’s understanding when mastering academic tasks (Biggs and Collis, 1982). In this model, the structure of observed learning outcomes is presented in five hierarchical levels ranging on the basis of the structural organisation of the knowledge in question from incompetence to expertise. These levels are prestructural, unistructural, multistructural, relational and extended abstract. Table 1.5 describes each level of SOLO taxonomy (Biggs and Collis, 1982; Biggs and Tang, 2011; Boulton-Lewis, 1995). Most of the learning is quantitative in the early stages of SOLO, with an increase in the amount of detail. In the subsequent stages, the learning becomes qualitative as details are integrated into a structural pattern. The aim of the quantitative dimension is an increase in knowledge gain, whereas the qualitative dimension aims for a deeper understanding (Lucander et al., 2010). The SOLO taxonomy is a powerful tool that could be utilised to both shape and assess learning in higher education (Boulton-Lewis, 1995).

Table 1.5: Description of SOLO levels

SOLO level	Description
Prestructural	Incompetent, nothing is known about the area
Unistructural	One relevant aspect is known
Multistructural	Several relevant independent aspects are known
Relational	Aspects of knowledge are integrated into a structure
Extended abstract	Knowledge is generalised into a new domain

(Source: Biggs and Collis, 1982)

1.3 Teaching and learning in higher education

Teaching and learning in higher education is a mutual responsibility between student and teacher, wherein their contribution to this process is essential for its success. Higher education is expected to engage students in reflecting on their own learning and questioning their concepts of how the world functions. Therefore, students' understanding can extend to a higher level. Nonetheless, students are not always prepared for this challenge, nor do they all have the aspiration to understand and apply knowledge. Instead, all students aim to survive the course or to learn with the desire to attain the highest grades (European Commission, 2013).

High-quality teaching motivates students to learn, and assists them to question their previous conceptions. This can occur when students are placed in a situation in which their existing model does not work, and they find this significant as they consider themselves responsible for change. In other words, learners need to face problems that they perceive to be important for them. Moreover, they need to be engaged with new questions that are related to their own lives and promote lively participation instead of only focusing on surviving assessment or exams (European Commission, 2013).

1.4 Quality assurance in higher education

The Quality Assurance Agency for Higher Education (QAA) is an independent body responsible for monitoring standards and quality of higher education in the UK. A key role of the QAA is to provide guidance and reference points (the UK Quality Code for Higher Education) for higher education providers. In addition, this body is in charge of conducting quality assessment reviews on the higher education providers to check whether they meet agreed UK expectations according to the quality code (QAA, 2017). The reviews are carried out by teams from a pool of more than 400 reviewers selected from different types of higher education institutions around the UK. It is worth mentioning that the QAA ensures that the reviewers are external to the institution being reviewed. In addition, the QAA involves students in all reviews, as they are partners in their learning experiences. Their responsibilities vary on the spectrum, from contributing to particular meetings to being a full member of a team in a review process (QAA, 2017).

The UK quality code for higher education involves setting and maintaining academic standards according to qualifications frameworks, characteristics statements, credit frameworks and subject benchmark statements. The quality code also covers academic quality, which evaluates the extent to which learning opportunities that are available to students enable them to achieve their award. Higher education providers are required to meet the following expectations: providing students with effective and appropriate teaching, support, assessment and learning resources; monitoring the learning opportunities and considering how to improve them. The final part of the quality code involves expectations about providing trustworthy and reliable information about higher education provision (QAA, 2017).

1.5 Pharmacy as a healthcare profession

The pharmacy profession can be linked to the Sumerian population who lived in what is known nowadays as Iraq. From nearly 4000 BC, they used plants that contain medicinal ingredients like opium, mustard, myrrh and liquorice to

treat certain conditions. At that time, preparation of medicines was carried out by particular individuals whose role was different from diagnosis and treatment. The earliest surviving prescriptions were written by the Sumerians around 5000 years ago (RPS, 2014).

Pharmacy is a multi-disciplinary science that involves drug discovery, synthesis, manufacturing and distribution, and providing patient care. Specifically, pharmacy is a health profession that connects chemical sciences and healthcare (Asiri, 2011). Pharmacy used to be the profession of compounding and dispensing medicines. Nowadays, the pharmacy profession has been expanded to include various services related to patient care such as medicines information, medication review and clinical practice (Traulsen and Almarsdóttir, 2005).

Pharmacists are specially educated and trained healthcare professionals who are responsible for managing the supply of medicines to patients and engaging in appropriate activities to ensure safe and effective use of these medicines. Because providing patients with medicines alone is not enough to attain the treatment goals, pharmacists have also become responsible for the outcomes of medicine use, and they can provide patients with enhanced medicine-use services such as anticoagulation monitoring and care home service (FIP and WHO, 2012).

Pharmacists' duties differ widely among the various areas of pharmacy practice. In the community, pharmacists are expected to dispense prescriptions, counsel patients and respond to their symptoms, promote health and conduct medication reviews (Holden, 2015; QAA, 2002). They are also responsible for providing pharmaceutical services to nursing and residential homes. Additionally, they can participate in needle exchange and supervised medicine administration schemes to limit the harm caused by drug misuse (QAA, 2002).

In hospitals, the key role of pharmacists is to provide clinical appraisal services. They are in charge of ensuring that prescriptions are both legal and

proper for the patient. Moreover, they provide medicine information for both physicians and nurses. Clinical pharmacists are directly involved in patient care by providing other healthcare professionals with prompt advice, developing treatment protocols, monitoring patient therapy and providing patient education (QAA, 2002).

The role of pharmacists in the pharmaceutical industry is different to that of those working in hospitals and community pharmacies. Industrial pharmacists are involved in a wide range of activities, such as advising on regulatory issues, new product formulation, planning and optimisation of strategies for drug development, management of large-scale production of medicines, and marketing (QAA, 2002).

1.6 Pharmacy education

In the United Kingdom (UK), the General Pharmaceutical Council (GPhC) regulates pharmacists, pharmacy technicians and pharmacy premises. This agency is also responsible for establishing measures for the education and training of pharmacists and pharmacy technicians. The principal roles of the GPhC include approving qualifications for pharmacists and pharmacy technicians; accrediting pharmacy education and training providers; and establishing standards for ethics, conduct, proficiency, education and training, and continual professional development. The academic degree offered to practise pharmacy is called Master of Pharmacy (MPharm). MPharm is a four-year undergraduate study followed by 52 weeks of pre-registration training (GPhC, 2011) (see Figure 1.6).

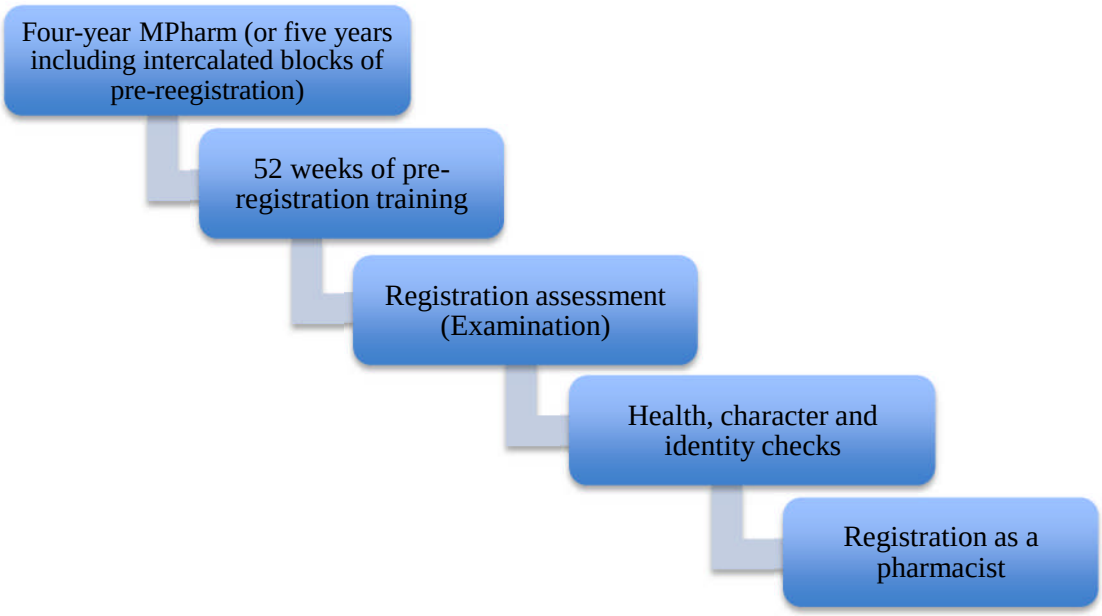

Figure 1.6: Initial Education and Training of Pharmacists in the UK

In the United States (US), however, a Doctor of Pharmacy (PharmD) has become the only professional degree allowing entry to pharmacy practice. Two years of particular undergraduate study has to be completed before entering the programme. This is followed by four years of didactic and experiential professional pharmacy education (AACP, 2014). Licensed pharmacists who undertake a PharmD programme from a pharmacy institution accredited by the Accreditation Council for Pharmacy Education (ACPE) in the US can enter a one-year pharmacy residency programme accredited by the American Society of Health-System Pharmacists (ASHP) (ASHP, 2014) (see Figure 1.7).

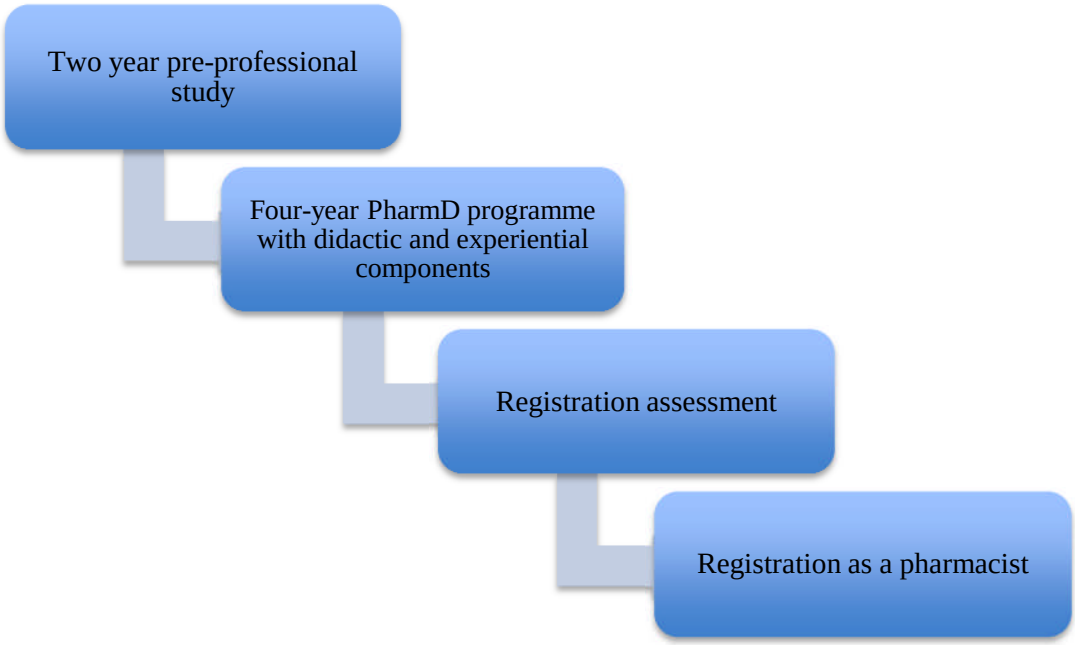

Figure 1.7: Initial Education and Training of Pharmacists in the US

In the UK, the subject benchmark statements present expectations about standards of degrees in a variety of subject areas. They illustrate what gives a discipline its coherence and identity, and describe the skills and attributes that a graduate is expected to demonstrate (QAA, 2017). According to the pharmacy subject benchmark statements, MPharm graduates *'must command a profound knowledge and understanding of medicines and the aptitude to apply such to health care, either by direct instructions or advice to patients or, very often, by properly informing and effectively influencing the decisions and actions of other health or social care professionals'* (QAA, 2002, p. 5).

QAA asserts that teaching and learning in MPharm programmes must enable the positioning of knowledge, understanding and capability in a pharmaceutical context, with frequent reference to examples from existing pharmaceutical practice. In addition, curriculum delivery must encourage students to take responsibility for their own lifelong learning (QAA, 2002).

According to the GPhC standards for the initial education and training of pharmacists (2011), MPharm degree curricula must be integrated and spiralling. This means that the education and training components need to be linked in a coherent way. In addition, the curricula must deal with issues in an increasingly more complex way with an aim to reach the right level of understanding. The GPhC asserts that learning opportunities in MPharm curricula must be designed to provide the following: an integrated experience of relevant science and pharmacy practice; a balance of theory and practice; and independent learning skills (GPhC, 2011). Assessment procedures used in MPharm programmes must test competence and achievement of the outcomes for the initial education and training of pharmacists specified by the GPhC. The outcomes have different levels, which are derived from Miller's triangle for assessment of clinical skills, competence and performance (Figure 1.8) (GPhC, 2011; Miller, 1990). Outcomes for the initial education and training of pharmacists are presented in Table 1.6.

The first level of Miller's triangle (Knows) represents the knowledge that might be applied in the pharmacist's future career to demonstrate competence. Examples of assessment methods that could be used to assess this level include essays, oral examinations and multiple-choice questions. The second level of Miller's triangle (Knows how) represents context-based tests that require the use of both knowledge and skills. The next hierarchal level Shows How. Assessment methods used to meet an outcome at this level require a pharmacy student or trainee to be able to demonstrate that they can perform in both a simulated environment and in real life, for instance, objective structured clinical examinations (OSCEs) and simulated patient assessments. The top level of Miller's hierarchy, Does, corresponds with assessment methods that enable the examination in context of the student's ability to demonstrate the outcomes in a complex and everyday situation repeatedly and reliably. OSCEs and observing trainees are two examples of the assessment procedures that could be used to assess an outcome at the final level of Millar's triangle (GPhC, 2011).

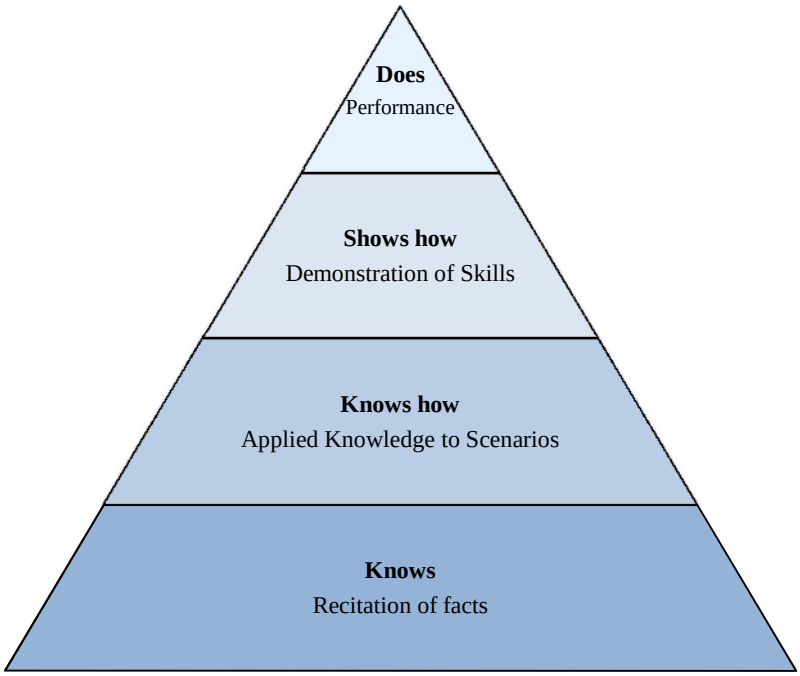

Figure 1.8: Miller's Triangle (Adapted from Gruppen et al., 2012 and Miller, 1990)

Table 1.6: Outcomes for the initial education and training of pharmacists (Adapted from GPhC, 2011)

10.1 Expectations of a pharmacy professional		
Outcomes	MPharm	Pre-reg*
Note: Pre-registration learning outcomes are for reference only if a four-year MPharm is being delivered		
a. Recognise ethical dilemmas and respond in accordance with relevant codes of conduct	Knows how	Does
b. Recognise the duty to take action if a colleague's health, performance or conduct is putting patients or the public at risk	Knows how	Knows how
c. Recognise personal health needs, consult and follow the advice of a suitability qualified professional, and protect patients or the public from any risk posed by personal health	Does	Does
d. Apply the principles of clinical governance in practice	Knows how	Does
e. Demonstrate how the science of pharmacy is applied in the design and development of medicines and devices	Shows how	Knows how
f. Contribute to the education and training of other members of the team through coaching and feedback	Shows how	Does
h. Engage in multidisciplinary team working	Knows how	Does
i. Respond appropriately to medical emergencies, including provision of first aid	Knows how	Shows how
10.2 The skills required in practice 10.2.1 Implementing health policy		
Outcomes	MPharm	Pre-reg*
a. Promote healthy lifestyles by facilitating access to and understanding of health promotion information	Shows how	Does
b. Access and critically evaluate evidence to support safe, rational and cost-effective use of medicines	Shows how	Knows how
c. Use the evidence base to review current practice	Shows how	Does
d. Apply knowledge of current pharmacy-related policy to improve health outcomes	Knows how	Shows how
e. Collaborate with patients, the public and other healthcare professionals to improve patient outcomes	Knows how	Shows how
f. Play an active role with public and professional groups to promote improved health outcomes	Knows how	Knows how
g. Contribute to research and development activities to improve health outcomes	Knows how	Knows how
h. Provide evidence-based medicines information	Shows how	Does
10.2.2 Validating therapeutic approaches and supplying prescribed and over-the-counter medicines		

Outcomes	MPharm	Pre-reg*
a. Identify and employ the appropriate diagnostic or psychological testing techniques in order to promote health	Knows how	Shows how
b. Identify inappropriate health behaviours and recommend suitable approaches to interventions	Shows how	Does
c. Instruct patients in the safe and effective use of their medicines and devices	Shows how	Does
d. Analyse prescriptions for validity and clarity	Shows how	Does
e. Clinically evaluate the appropriateness of prescribed medicines	Shows how	Does
f. Provide, monitor and modify prescribed treatment to maximise health outcomes	Shows how	Does
g. Communicate with patients about their prescribed treatment	Shows how	Does
h. Optimise treatment for individual patient needs in collaboration with the prescriber	Shows how	Does
i. Record, maintain and store patient data	Shows how	Does
j. Supply medicines safely and efficiently, consistently with legal requirements and best professional practice. NB This should be demonstrated in relation to both human and veterinary medicines	Shows how	Does
10.2.3 Ensuring that safe and effective systems are in place to manage the risk inherent in the practice of pharmacy and the delivery of pharmaceuticals services		
Outcomes	MPharm	Pre-reg*
a. Ensure quality of ingredients to produce medicines and products	Knows how	Shows how
b. Apply pharmaceuticals principles to the formulation, preparation and packing of products	Shows how	Shows how
c. Use pharmaceutical calculations to verify the safety of doses and administration rates	Does	Does
d. Develop quality management systems including maintaining appropriate records	Shows how	Shows how
e. Manage and maintain quality management systems including maintaining appropriate records	Shoes how	Does
f. Procure and store medicines and other pharmaceutical products working within a quality assurance framework	Knows how	Does
g. Distribute medicines safely, legally and effectively	Knows how	Does
h. Dispose of medicines safely, legally and effectively	Knows how	Does
i. Manage resources in order to ensure work flow and minimise risk in the workplace	Knows how	Shows how
j. Take personal responsibility for health and safety	Does	Does
k. Work effectively within teams to ensure that safe effective systems are being followed	Knows how	Does

l. Ensure the application of appropriate infection control measures	Shows how	Does
m. Supervise others involved in service delivery	Knows how	Does
n. Identify, report and prevent errors and unsafe practice	Shows how	Does
o. Procure, store and dispense and supply veterinary medicines safely and legally	Knows how	Knows how
10.2.4 Working with patients and the public		
Outcomes	MPharm	Pre-reg*
a. Establish and maintain patient relationships while identifying patients' desired health outcomes and priorities	Shows how	Does
b. Obtain and record relevant patient medical, social and family history	Shows how	Does
c. Identify and employ the appropriate diagnostic or physiological testing techniques to inform clinical decision-making	Knows how	Shows how
d. Communicate information about available options in a way which promotes understating	Shows how	Does
e. Support the patient in choosing an option by listening and responding to their concerns and respecting their decisions	Shows how	Does
f. Conclude consultation to ensue satisfactory outcome	Shows how	Does
g. Maintain accurate and comprehensive consultation records	Shows how	Does
h. Provide accurate written or oral information appropriate to the needs of patients, the public or other healthcare professionals	Shows how	Does
10.2.5 Maintaining and improving professional performance		
Outcomes	MPharm	Pre-reg*
a. Demonstrate the characteristics of a prospective professional pharmacist as set out in relevant codes of conduct and behaviour	Does	Does
b. Reflect on personal and professional approaches to practice	Does	Does
c. Create and implement a personal development plan	Does	Does
d. Review and reflect on evidence to monitor performance and revise professional development plan	Does	Does
e. Participate in audit and in implementing recommendations	Knows how	Shows how
f. Contribute to identifying the learning and development needs of team members	Knows how	Does
g. Contribute to the development and support of individuals and teams	Knows how	Does
h. Anticipate and lead change	Knows how	Shows how

1.7 Mechanisms for improving students' learning experience in undergraduate higher education

1.7.1 The National Student Survey

The National Student Survey (NSS) gathers opinions from final year undergraduate students about the quality of their courses. The purpose of NSS is twofold: to enable prospective students to make informed decisions about where and what to study by comparing NSS data that is published annually on the Unistats website, and to help institutions to enhance the student experience for both current and prospective students (HEFCE, 2016a; NSS, 2017).

1.7.2 The Teaching Excellence Framework

The Teaching Excellence Framework (TEF) was introduced by the UK government in 2016 with the aim of recognising and rewarding excellent teaching and learning in higher education institutions (HEFCE, 2017). The key purpose of TEF is to give prospective students information about where teaching quality is best and where students have attained the best outcomes. In addition, it encourages higher education institutions to improve their teaching quality and to recognise and reward good practice (HEFCE, 2016b; UCL, 2017a). The Higher Education Funding Council for England (HEFCE) is responsible for implementing the TEF exercise in 2017 in accordance with the Department for Education specification. An institution that applies for the TEF in 2017 will achieve one of the following three levels of excellence: Gold (the provision is consistently outstanding and of the highest quality found in the UK Higher Education sector), Silver (the provision is of high quality, and significantly and consistently exceeds the baseline quality threshold expected of UK Higher Education), or Bronze (the provision is of a satisfactory quality). The TEF will consider teaching excellence across the following three main aspects: teaching quality, learning environment, and student outcomes and learning gain (HEFCE, 2016b). The TEF rating will be assessed by metrics and written evidence of teaching and learning activities that mark the institution as distinctive, or surpass the QAA standards for teaching quality

(HEFCE, 2016b; UCL, 2017a). The metrics that will be assessed include the following: NSS responses on ‘teaching on my course’, ‘assessment and feedback’ and ‘academic support’; non-continuation from the Higher Education Statistics Agency; figures on the proportion of former students in both employment or further study and highly skilled employment or further study derived from the Destination of Leavers from Higher Education (HEFCE, 2016b).

1.8 Chapter summary

Understanding the unique characteristics of adult learning is crucial as it could shape the development of learning opportunities for adult learners. Adult learning is explained in a number of theories, frameworks and models. However, Knowles’ andragogy is considered the best-known theory that describes adult learning. This andragogy offers six core principles of adult learning: learner’s need to know, self-directed learning, prior experience of the learner, readiness to learn, orientation to learning and problem solving, and motivation to learn. Applying the andragogy in practice requires the consideration of individual and situational differences.

Defining and distinguishing different levels of learning development can be achieved by using tools from learning taxonomies. Bloom’s and the SOLO taxonomies are well-known models that can guide the development of course curricula, teaching methods and assessment.

Teaching and learning in higher education is a shared responsibility between student and educator. Higher education is expected to engage students in reflecting on their own learning and extending their understanding to a higher level, instead of only focusing on surviving assessment or exams.

Monitoring standards and quality of higher education in the UK is performed by the QAA, which is responsible for providing guidance and reference points to higher education providers.

Pharmacy is a multi-disciplinary science that involves drug discovery, synthesis, manufacturing and distribution, and providing patient care. Pharmacists are specially educated and trained healthcare professionals with diverse responsibilities in various areas of pharmacy practice.

The GPhC is the regulatory body in the UK that is responsible for managing pharmacists, pharmacy technicians and pharmacy premises. MPham, which is a four-year undergraduate study followed by 52 weeks of pre-registration training, is the academic degree offered in the UK to practise pharmacy.

Improving the quality of higher education institutions in the UK can be encouraged by the NSS and the TEF. The NSS gathers information from final year undergraduate students about their opinions of the quality of their courses. The TEF was introduced by the UK government in 2016 with the aim of recognising and rewarding excellent teaching and learning in higher education institutions.

Chapter 2 The flipped classroom instructional model in higher education: A literature review

The purpose of this chapter is to review the literature on implementing the flipped classroom teaching approach in higher education institutions worldwide. It covers a brief introduction about the traditional lecture and the flipped classroom teaching approaches, the research questions and aims and objectives for the literature search, the methodology, the results, and finally it provide a discussion of the findings.

2.1 Introduction

The traditional lecture-based method of teaching has been predominant in university classrooms worldwide. This conventional teaching approach hinders inexperienced students from actively participating in the learning process, which is attributed to using the class time by the lecturer to transmit knowledge and facts. Students, in turn, spend their time in taking notes about the presented lecture which need to be recorded and learnt (Van Dijk and Jochems, 2002). The academic orientation and commitments of students is a major source of diversity in university classrooms. Academically committed students are normally interested in their studies and have clear academic or career plans. Therefore, what they learn is important to them so they spontaneously use a deep approach to learning even if the traditional lecture is used as a method of instruction. In contrast, less academic students are mainly motivated in obtaining a qualification for a decent job. Traditional lectures, therefore, commonly allow them to use a surface approach to learning focusing on note taking and memorising which is usually below the cognitive level required for achieving the intended learning outcomes (Biggs and Tang, 2011).

Higher education in the US has come under close scrutiny for its failure in adequately educating students. The recent evidence indicates that the vast majority of college graduates lack fundamental proficiencies such as critical thinking, complex reasoning and written communication skills (McLaughlin et

al., 2013). Several calls for reforms, therefore, have been raised in order to modify the traditional lecture format to better prepare graduates for future practice (Kurup and Hersey, 2013; McLaughlin et al., 2013; Prober and Khan, 2013). Health profession schools have been facing a challenge of providing a high standard of education that prepares their graduates to meet the evolving needs of society for healthcare services (McLaughlin et al., 2013).

The traditional classroom is typically run by a lecturer who presents new materials to students each session. Students generally take notes in the lecture, which are reviewed at a later time (Gannod et al., 2008; Moravec et al., 2010; Talbert, 2012). Assignments, projects and other tasks are ordinarily completed outside the class time (Talbert, 2012). Students' understanding of the module is evaluated by summative assessments (Moravec et al., 2010).

A considerable volume of literature indicates that there is a necessity to reconsider how the scheduled class time is used (McLaughlin et al., 2013). There is a consensus that the attention span of students drops significantly after the first ten minutes of a lecture and students can keep their attention for a maximum of 15-20 minutes (Bligh, 2000; Brown, 1978; McLaughlin et al., 2013). Students' attention, however, returns at the end of lecture, but students can only remember 20% of content delivered in class (McLaughlin et al., 2013). This view is based on repeated research on student attentiveness in many disciplines at different levels of study and different countries (Bligh, 2000; Brown, 1978). This could be linked to the primacy and recency phenomena in which an individual can better remember items at the beginning and end of a list than those in the middle when exposed to a particular learning experience (Greene et al., 2000; Morrison and Conway, 2014). In primacy, information could be stored indefinitely in long-term memory, whereas recency occurs in the short-term memory system which does not maintain unrehearsed information for more than 20 seconds. Therefore, short-term memory can only retain the last few learned items (Greene et al., 2000). Thus, the lecture content should be presented in a

proper sequence for the learner to absorb and learning should be broken up to facilitate recall.

The conventional model of teaching is limited by the fact that students receive information passively and are not actively engaged throughout the learning process (Moravec et al., 2010; Pierce and Fox, 2012). This is due to the limited class time that is typically spent on covering the content of the syllabus rather than doing in-class activities that facilitate active learning (Gannod et al., 2008). The evidence suggests that engaging students in class through active learning approaches such as group work, case studies, self-reflection and debates is linked to improved student performance, motivation and attitudes. Additionally, it improves higher-order thinking, critical analysis and problem-solving skills. Both the student and lecturer can be advantaged from formative feedback provided in class (Gannod et al., 2008; McLaughlin et al., 2013; Moravec et al., 2010).

It is also claimed that the traditional lecture format does not customise the instruction in terms of the needs and capabilities of individual students. Personalised teaching and active students' engagement can be achieved by a blended learning approach that utilises technology in an attempt to *flip* or *invert the classroom* (Davies et al., 2013).

> An inverted classroom is a teaching environment that mixes the use of technology with hands-on activities (Gannod et al., 2008, p. 777).

> The flipped classroom is a hybrid approach to learning, using technology to move the classroom lecture to "homework" status and using face-to-face classroom time for interactive learning (Missildine et al., 2013, p. 598).

In a flipped classroom pedagogical model, instructional resources are provided for students to use outside of class. Therefore, the class time is freed up for more engaging learning activities facilitated by the lecturer (Bergmann and Sams, 2012; Critz and Knight, 2013; Davies et al., 2013; Enfield, 2013; Gannod et al., 2008; Kurup and Hersey, 2013; Lage et al.,

2000; Talbert, 2012). Fundamentally, the flipped classroom requires students to prepare for the class by watching online pre-recorded lectures, participate in online discussion boards, and complete required reading materials (Critz and Knight, 2013). Students' self-motivation to complete course requirements and the learning activities, therefore, is a key for the success of this model. Information is available for students to access at their own pace. Thus, the learner can advantage from pausing, fast-forwarding, rewinding and replaying the recorded materials (Gannod et al., 2008).

In the flipped classroom paradigm, the scheduled class time is devoted for interactive activities and learning experiences which are targeted towards engaging students and promoting higher-order thinking skills (Davies et al., 2013; Kurup and Hersey, 2013). Thus, more interaction takes place between the teacher and learners when compared to the traditional method of teaching (Pierce and Fox, 2012).

The concept of the flipped classroom is not new. It has been used for centuries in the humanities disciplines where students are required to prepare for in-class discussions by completing reading materials. The case study approach that has been utilised in business and law schools is another example of the teaching methods that require pre-class preparation (Talbert, 2012).

Bergmann and Sams (2012) were the early adopters and outspoken advocates of the flipped classroom instructional model. In 2007, they recorded their live chemistry lectures for high school students who missed classes and struggled to catch up (Bergmann and Sams, 2012; Critz and Knight, 2013; Pierce and Fox, 2012; Talbert, 2012). Unfortunately, students found it difficult to complete their homework using the recorded lectures. Hence, the class was transformed and flipped for all students. Chemistry lectures were pre-recorded and the class time was used to help students to understand problematic concepts (Bergmann and Sams, 2012).

The following literature review was undertaken to evaluate the efficacy of flipping the traditional lecture-based classroom. Moreover, it will describe how studies implemented the flipped classroom instructional model and it will document their recommendations based on the evidence and observations.

2.2 Aims and Objectives for the Literature Search

2.2.1 Aims

The aim of this literature review is to determine the feasibility and effectiveness of the flipped classroom educational model used in higher education institutions.

2.2.2 Objectives

1) To describe methodologies used for flipping and restructuring the traditional classroom in pharmacy and other higher education disciplines.
2) To assess the impact of the flipped classroom on students' academic achievements and learning outcomes.
3) To determine students' and lecturers' perception of the flipped classroom model.
4) To document issues and challenges connected to flipping the traditional lecture.
5) To recommend new or adapt existing approaches to learning based on evidence found in literature.

2.3 Methodology

2.3.1 Search Sources and Strategies

In order to identify potential relevant research articles evaluating the flipped classroom educational approach, the following electronic databases were searched: EMBASE, PsycINFO, PubMed, SCOPUS, ERIC, CINAHL, AEI, BEI. Hand searching of the reference lists of the retrieved studies was performed to identify further relevant publications. Terms and key words used to conduct the literature search include the following: "flipped

classroom", "inverted classroom", "classroom flip", "flipped learning", and "inverted learning" (see Table 2.1: Search Terms Used in the Review).

Table 2.1: Search Terms Used in the Review

Database	Search term	Total number of hits
Embase 1980-2014 week 06	Flip$	11387
	Invert$	72541
	Flip$ or invert$	83802
	Classroom	9594
	(Flip$ OR invert$) AND Classroom	24
PsycINFO 1806 to January Week 3 2014	Flipped classroom	5
	Inverted classroom	2
	Classroom flip	3
	Flipped learning	0
	Inverted learning	1
	Flipped classroom OR inverted classroom OR classroom flip OR flipped learning OR inverted learning	8
PubMed	Inverted classroom	3
	Flipped classroom	17
	Classroom flip	4
	Flipped learning	27
	Inverted classroom OR flipped classroom OR classroom flip OR flipped learning	39
SCOPUS	Flipped classroom	31
	Inverted classroom	13
	Classroom flip	22
	Flipped learning	37
	Flipped classroom OR inverted classroom OR classroom flip OR flipped learning	58
ERIC	(Flip$ OR invert$) AND classroom	18

Database	Search term	Total number of hits
CINAHL Plus	Flipped classroom	8
	Inverted classroom	0
	Classroom flip	1
	Flipped learning	7
	Flipped classroom OR inverted classroom OR classroom flip OR flipped learning	8
Australian Education Index (AEI)	Flipped classroom	3
	Inverted classroom	1
	Classroom flip	4
	Flipped learning	3
	Flipped classroom OR inverted classroom OR classroom flip OR flipped learning	8
British Education Index (BEI)	Flipped classroom	0
	Inverted classroom	0
	Classroom flip	1
	Flipped learning	1
	Flipped classroom OR inverted classroom OR classroom flip OR flipped learning	2
Total number of hits		165

2.3.2 Selection Criteria

Articles that met the following inclusion criteria were selected: (1) journal articles evaluating the efficacy of flipped classrooms in higher education; (2) empirical studies with primary data; (3) research papers published in English. Reviews, notes, editorials and conference papers were excluded from the review.

2.3.3 Procedure for Extracting Data

Electronic database searches were conducted to identify studies that meet the inclusion criteria. Entering the key words revealed the following number of articles: EMBASE (*n*=24); PsycINFO (*n*=8); PubMed (*n*=39); SCOPUS (*n*=58); ERIC (*n*=18); CINAHL plus (*n*=8); AEI (*n*=8); BEI (*n*=2). The search yielded a total of 165 publications. The first stage of the review involved screening titles and abstracts of the revealed studies. This phase resulted in excluding 145 articles for the following reasons: duplicates (*n*=38), conference papers (*n*=15), editorials (*n*=12), reviews (*n*=3), notes (*n*=4), thesis (*n*=1), irrelevant (*n*=72).

Full-texts of potentially relevant research studies (*n*=20) were obtained electronically (*n*=18) or on paper (*n*=2) to be assessed again for inclusion. A total of 11 articles were excluded in the second stage of the review for the following reasons: attending class was optional (*n*=1), distance education (*n*=1), traditional lecture was not delivered through other medium (*n*=3), no figures (*n*=3), review (*n*=2), no interactive activities (*n*=1). Hand searching of the reference lists of the relevant nine articles has identified three relevant publications. A total of 12 full-text articles were included in this review. A standardised data extraction sheet (Appendix 1) was used to document the details of the studies reviewed (see Figure 2.1: Flow Chart of the Literature Review Process).

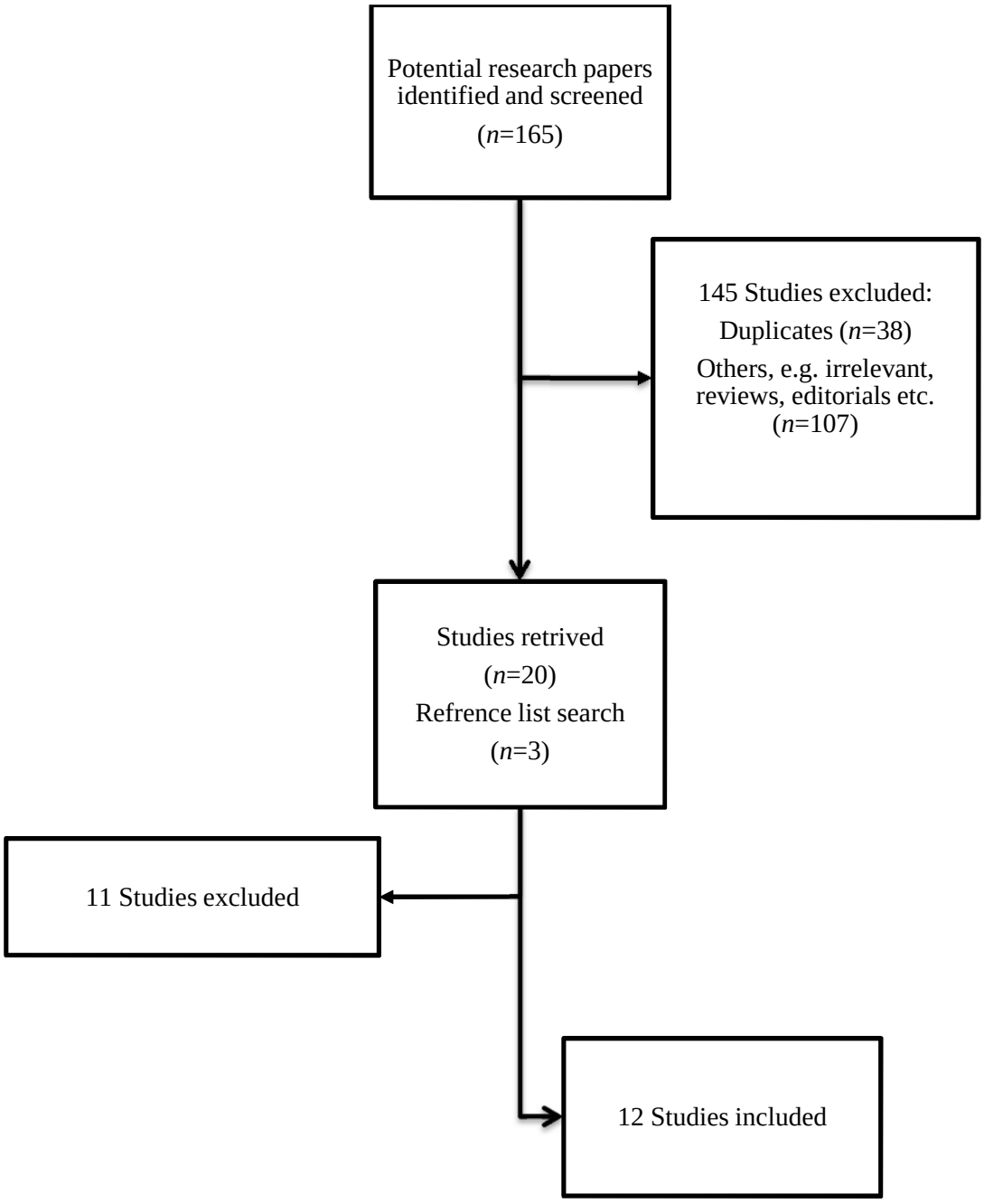

Figure 2.1: Flow Chart of the Literature Review Process

2.4 Results

Out of the 12 research studies that met the inclusion criteria, only five were conducted in healthcare professions institutions: two in pharmacy education (McLaughlin et al., 2013; Pierce and Fox, 2012); one in medical (Tune et al., 2013); two in nursing (Critz and Knight, 2013; Missildine et al., 2013). The other studies were undertaken in non-healthcare disciplines, which are biology (Moravec et al., 2010), chemistry (Smith, 2013), statistics (Strayer, 2012), economics (Lage et al., 2000), multimedia (Enfield, 2013), mathematics (Love et al., 2013) and engineering (Mason et al., 2013).

Pierce and Fox (2012) investigated the impact of flipping a renal pharmacotherapy module on pharmacy students' performance and attitudes. Students completed a pre-test, consisting of 17 multiple choice questions, on the first day of the module and a post-test at the end of the module. Before coming to the scheduled class, students had to view a video podcast of the lecture. The video podcasts were originally recorded from the live lectures of the same module delivered the previous year by the same lecturer. Interactive activities, based on the process oriented guided inquiry learning (POGIL) approach, were implemented in the class to complement and apply the content of the assigned recorded lectures. Pierce and Fox's (2012) study was conducted over a relatively short period of time (four video lectures and two active learning sessions) (Pierce and Fox, 2012).

Measuring students' performance on the renal pharmacotherapy module was attained by pre-test/post-test comparison and by comparing intervention/control group final exams grades. There was a significant difference between the pre-test (33.5 $\pm$ 11.6, range 0-59) and post-test (79.2 $\pm$ 10.6), range 53-100) scores, p <0.001. Likewise, the flipped classroom group achieved significantly higher grades (81.6 + 4.4, range 43-100) than the traditional lecture group (77.7 + 4.7, range 43-100), P=0.024 (Pierce and Fox, 2012). While the authors reported a significant difference in the final exam grades between the study and control group, information about the sample size, characteristics and demographic data of the control group is

lacking and there is no baseline measurement for the control group. This, therefore, questions the similarity between participants in the study and the control group. Ensuring that the outcomes are due to the flipped classroom cannot be guaranteed as it might be related to difference between the two groups. Another limitation found in this study was the use of identical exam questions to assess students in both groups. Comparable questions with similar difficulty could have been used to avoid the risk of plagiarism.

In order to assess students' perception of the flipped classroom instructional model and the POGIL (process oriented guided inquiry learning) activities, students were requested to complete an online survey. The overall response rate was 73% and the majority of students were in favour of the flipped approach and the POGIL activities. Ninety-six percent of students reported that they viewed the assigned video lecture before the scheduled class and it assisted them to prepare for the in-class activities (Pierce and Fox, 2012).

A study by McLaughlin and colleagues (2013) involved a complete redesigning of the basic pharmaceutics course taught to first professional year PharmD students in a US university. The course was reformed by replacing the traditional lecture format, which consisted of a 75-minute lecture and an infrequent 15-minute active learning exercise, with an online, recorded lecture and assigned reading materials. The freed-up scheduled class time was devoted to the following active learning activities: a 15-minute assessment of students' foundational learning (audience response using clickers and open questions); a 15-minute pair and share activity; a micro-lecture as needed; a 25-minute student presentation and discussion; a 20-minute individual or group quiz. Feedback and formative assessment of students' learning was provided instantly in order to address any misconceptions or gaps in students' understanding (McLaughlin et al., 2013).

To ease the process for students to adjust to the flipped classroom model, they were provided with a comprehensive syllabus that described the course in detail and illustrated the inspiration for the course alteration. Additionally, they were provided with a guide with recommendations and advice on how to

successfully complete the course under the new format; for instance, students were advised to review the assigned materials prior to each scheduled class in order to actively contribute in the class activities. The researchers of this study stated that flipping the traditional basic pharmaceutics course required 170% more time of the faculty member and 93% more time of the teaching assistant who facilitated the in-class activities and provided feedback. However, the researchers expect a drop in the time commitment of the faculty member in the subsequent years as the recorded lectures can be reused (McLaughlin et al., 2013). Two different academic staff were involved in facilitating three sections of the flipped classroom model. Therefore, the quality of teaching delivered to students may vary between the groups.

A pre- and post-course survey instrument was administered to students to determine their perception about the new class format. Ninety-two per cent of students completed the survey, with 82% of them reporting that they viewed all the assigned video lectures. Students' perception of the inverted classroom format was mainly favourable. However, the number of students who believe that the assigned reading materials enhanced their learning has significantly dropped in the post-course survey. Comparing the final exam grades (out of 200) of the traditional (160.06 $\pm$ 14.65) and the flipped model (165.48 $\pm$ 13.34) showed a significantly statistical difference (p= 0.001) (McLaughlin et al., 2013).

The intervention developed in a study of the flipped classroom experience in a paediatric course in a graduate nursing programme was slightly different from those in the above reviewed studies. In addition to the recorded video lectures, students had to read assigned textbook materials and between four and five up-to-date, evidence-based, and peer-reviewed journal articles selected by the lecturer. Furthermore, students were required to complete an online pre-class quiz. The online quiz questions were taken from a question bank to ensure that all students received different questions but with similar difficulty (Critz and Knight, 2013). Critz and Knight's (2013) study was

conducted over a relatively long period of time (11 weeks), but it was based on a small sample size (20 students).

Class time was spent on the following activities: intensive case studies, role-playing, group problem-solving exercises, reviewing interesting cases from the experiential portion of the course, and occasional faculty and students' lectures. The investigators of this study reported that flipping the classroom is time demanding and it needed support from information technology staff. Conversely, this model allowed students to take responsibility for their own learning and engage in the class exercises. Furthermore, this model of teaching allowed educators to assess students learning and correct their misunderstandings. The student satisfaction survey showed that students were generally positive about the new instructional pedagogy. However, students' comments on listening to in-class lectures by peers indicate that this strategy is not favourable (Critz and Knight, 2013). The authors of this paper did not state the response rate of the survey. Therefore, it is not obvious if the results represent the opinion of the majority of students or not.

Tune, Sturek and Basile (2013) compared the efficacy of a conventional lecture format curriculum versus a flipped classroom curriculum in the context of renal, cardiovascular and respiratory physiology delivered to first-year medical students. Twenty-seven graduate students participated in this study, 14 students (12 male, two female) were enrolled in the traditional lecture-based course, while 13 students (three male, 10 female) were enrolled in the modified flipped course. It is worth noting that students were not aware of the difference in course design prior to enrolment. These investigators were interested in seeing how the lecture format differs from the flipped model with respect to students' academic achievement and their opinion about the flipped classroom format (Tune et al., 2013). Duration of the study and the length of each pre-recorded lecture and class were not reported.

In the lecture-based course, live lectures were presented to students during the timetabled class. Attendance at lectures was neither compulsory nor

recorded. These lectures were recorded and made available online for students to view at any time. Students enrolled in the flipped model were required to watch the recorded lectures before coming to class. Class time, therefore, was reserved for quizzes and group discussions. Students' performance in both groups was assessed by identical multiple-choice question examinations. The results showed that students in the flipped classroom cohort outperformed those in the traditional lecture-based cohort ($p \leq 0.05$ for the cardiovascular and respiratory; $p = 0.06$ for the renal part) (Tune et al., 2013).

Results from a students' opinion survey (100% response rate) indicated that students were generally positive about the new instructional strategy and they became more enthusiastic about it towards the end of the course. However, some students were critical about the high workload, and having quizzes before the group discussion and the questions and answers period (Tune et al., 2013). Tune and colleagues' study was based on comparing two groups of students with similar academic indices but with different gender balance in which more women than men were involved in the flipped classroom group and the opposite was true for the traditional classroom cohort. This may suggest that male students could have different perceptions about the flipped classroom than female students.

Although the phrase flipped classroom was not actually used, Moravec and colleagues (2010) examined this instructional strategy in their research that involved 795 students in an introductory biology class. Mini-active learning exercises of no more than 15 minutes per lecture were used in the biology class before the course re-design. In this research, out-of-class activities included either listening to a narrated PowerPoint video or completing a worksheet, in addition to completing an online test. In order to motivate students to complete the assigned tasks, a credit worth 1% of the total grade was allocated for uploading and completing an assignment. Additionally, students received 0.25% credit of the final grade for completing an online test (Moravec et al., 2010).

Active learning strategies utilised during the contact hours included clicker questions using an audience response system, problem-based discussions and presenting interactive demonstrations. The evidence suggested that 1% of the final grade credit was an acceptable motivation to encourage 90% of students to upload and complete the assigned materials. Final exam comparison with the previous two years' classes showed that students in the flipped classroom achieved significantly higher scores than those in the traditional biology class ($p<0.001$). The majority of students were in favour of the new class format (Moravec et al., 2010).

A number of limitations have been identified in this study. Firstly, it was undertaken over a short period of time (three teaching sessions) and one of the comparable questions was identical between the years; therefore, the risk of passing the exam question to the recent students is possible. Secondly, only 56% of students completed the perception survey. Therefore, students who did not complete the survey might have had different opinions. Thirdly, the results of the survey were not reported comprehensively. Thus, the reported finding might be biased. Additionally, the academic year of participants was not reported.

In a study that set out to determine students' attitudes towards inverting the general chemistry classroom over a period of two years, Smith (2013) delivered the content of the curriculum through a range of online mini-lectures. Students ($n=235$) were expected to view the assigned mini-lectures in order to engage in the in-class activities. The author did not state the year group of students to which the general chemistry course was taught, nor did he specify the demographic characteristics of students involved in this study. The in-class activities were similar to those utilised in Tune et al.'s (2013) study, but the sequence was different. In Smith's study students were able to ask questions about the recorded lecture materials before taking the quiz (graded in the second year of the study). Evidence drawn from a student perception survey indicated that students found flipping the classroom burdensome, yet beneficial in numerous aspects (Smith, 2013). The number

of students who responded to the opinion survey was not reported in this study. Therefore, it is unclear what percentage of participants the survey findings represent. Another weakness noticed in Smith's study is the inconsistency in the implementation process of the flipped classroom throughout the years. The in-class quizzes, for instance, were not graded in the first trial of this approach.

Strayer (2012) made a comparison between the learning environments of a traditional introductory statistics module with a flipped introductory statistics module taught in a US university. Unlike other studies conducted on the flipped classroom model, Strayer (2012) used an automated tutoring system to deliver the knowledge-based content of the course outside the class. Although students in the flipped classroom group felt less satisfied with how the classroom structure oriented them to the learning activities in the course, they were in favour of the corporative learning and innovative teaching strategies offered by the new course structure (Strayer, 2012). Strayer (2012) believes that the flipped classroom approach is not the ideal design for introductory courses as students have a low interest in the subject and encountering challenges may frustrate them. The survey instrument used in Strayer's study has a discriminate validity and an acceptable internal consistency, with a Cronbach's alpha coefficient ranging from 0.7 to 0.9. However, the percentage of students who returned the survey was not reported.

In a study by Lage et al. (2000), a specific module, Introduction to Microeconomics, was restructured fully by requesting students (n=200) to prepare for scheduled classes by reading assigned sections of a textbook and viewing either PowerPoint lectures with sounds or videotaped lectures. Moreover, students were expected to complete worksheets. The goal of the course modification was to allow students to learn the course content according to their personal learning style. Class sessions would start with answering students' questions, which led to a small lecture of no longer than ten minutes. If students did not ask any questions, the lecturer would not give

a mini-lecture. The second part of the session would be spent on conducting an economic or laboratory experiment related to the topic being discussed. The rest of the class time was spent on discussing students' answers to the worksheet and asking review questions (Lage et al., 2000). This study involved a large sample size of students divided into five sections facilitated by two different lecturers. Examinations, assignments and in-class activities were the same for all groups. There is a possibility here that there might have been a level of unequal teaching input provided by the two different lecturers.

In order to encourage students to prepare for the session, the instructor would randomly collect the assigned worksheets and grade them for completeness. The results from both students' perception survey (94.5% response rate) and lecturers' opinion showed that the flipped classroom teaching model was preferred over the traditional lecture-based method of teaching. In fact, the evidence suggested that this method increased the interaction between students and lecturer. Additionally, it improved students' communication skills and provided flexibility in learning the content in different formats (Lage et al., 2000).

In addition to students' performance and satisfaction with the flipped model, Mason and co-workers (2013) also compared content coverage of the flipped classroom to the traditional one in a control systems course taught on a Mechanical Engineering programme. In this study, the flipped classroom students had to watch a recorded lecture in order to participate in problem-solving exercises taking place during the class time. However, students' engagement in solving those exercises was only occasional in the traditional lecture-based classroom (Mason et al., 2013).

Results from this comparative study showed that students' performance on comparable quizzes, exams and open-ended problems in the flipped classroom was similar to or better than that of the traditional model. Additionally, the lecturer was able to cover more materials in the inverted classroom. Students' satisfaction survey and in-class discussion indicated that the flipped classroom was perceived by students to be an effective and

satisfactory format to teach control systems. Students, however, reported that they were initially unsatisfied with the new teaching format, but they adjusted rapidly. Unexpectedly, the number of hours spent by students studying outside the classroom was significantly fewer in the flipped classroom group. The return rate of the survey was not reported in this study. Thus, the results of the survey might not represent the views of all students. The investigators of this research stated that a considerable amount of time was required initially to record lecture videos and to create problems for the in-class activities (Mason et al., 2013).

Enfield (2013) conducted a study over one semester to examine the effectiveness of the flipped classroom instructional approach on undergraduate multimedia students. Preparation for in-class activities required students to view recorded lectures for the majority of the course content and to complete reading materials for two sessions. In order to encourage students to complete the assigned materials, they were given a short quiz at the beginning of each class session. This quiz would also provide the instructor with a formative assessment of students' understanding (Enfield, 2013). Data on students' characteristics, e.g. mean age and year group of students, was lacking in this study.

Lecturer observations indicated that the quiz was a strong stimulus for students to prepare for the scheduled class as students' engagement and attendance at the session dropped after the quizzes were stopped towards the end of the term. This evidence was also proved by the students' opinion survey (74% completed the survey) in which 81.1% of students stated that they viewed the recorded lectures because there were assigned summative quizzes. Overall, students were positive about the flipped classroom model. Instructional videos were perceived as engaging, helpful and appropriately challenging. The in-class activities were reported to be engaging (Enfield, 2013).

Love et al. (2013) examined the impact of flipping a linear algebra course in a US university. In this study, the same lecturer taught two sections of a linear

algebra course in which one was flipped and the other was taught in the traditional lecture-based format. Students were able to choose the time slot that best fit into their schedule without being aware of the class instructions format. Online pre-recorded lectures were made available for both cohorts. Students in the flipped classroom cohort, however, had to prepare for the scheduled classes by viewing online lectures and completing readiness tests. The readiness test would guide the lecturer to fill any gap in students' understanding. In-class activities included lecturer-led discussion and interactive problem-solving either in pairs or in a large group (Love et al., 2013).

Students' progress through three mid-term exams was compared. The results showed that students' progress was significantly greater for the flipped classroom students when compared to that of the traditional lecture format cohort ($p<0.05$ and $p<0.01$). However, final exam grades comparison revealed no significant difference between the two cohorts. Students in both sections were administered an end of term survey in order to assess their perception of the instructional format used. The results of the survey indicated that 74% of students in the flipped classroom cohort were positive about the new class format. The majority of them found that group activities helped them to become more socially comfortable with their peers. Additionally, most of the students agreed that explaining an idea or a problem to their peer was a key in developing a deeper understanding (Love et al., 2013). The authors claimed that students performed similarly in final exams. However, there was no evidence of performing statistical analysis on the final exam scores. Another limitation found in this study is the overall response rate to the students' survey was not reported. Additionally, characteristics and demographics of the control and the study groups were not stated. Therefore, similarity between the two groups cannot be guaranteed.

Missildine et al. (2013) conducted a study aimed at comparing three teaching approaches in two series of an adult health course: traditional lecture only,

traditional lecture supplemented by pre-recorded lectures, and the flipped classroom format of pre-recorded lectures and in-class interactive activities. The mean age of participants was 24.32 years (*SD*=6.71). A power of 0.80 was used and resulted in a required sample size of at least 53 participants for each course and approach. The authors of this study do not state whether or not the same lecturer taught the three groups of students. Students' examination scores comparison indicated that students in the flipped classroom group (*M*=81.89, *SD*=5.02) significantly outperformed those in the traditional lecture only (*M*=79.79, *SD*=4.51) and traditional lecture with pre-recorded lecture (*M*=80.7, *SD*=4.25) groups ($p<0.001$). A faculty-developed satisfaction survey was administered to 589 students in the three delivery methods and achieved a 75.55% response rate. Students' average satisfaction rank was calculated and it showed that students in the flipped classroom group were less satisfied than those in either of the other groups ($p<0.001$) (Missildine et al., 2013) (see Table 2.2: Summary of Published Studies on Flipped Classroom Instructional Approach in Higher Education).

Table 2.2: Summary of Published Studies on Flipped Classroom Instructional Approach in Higher Education

Author/Year/ Country	Discipline or sub-discipline	Course	Sample size	Out-of-class activities	In-class activities	Measurement instrument
Critz and Knight/2013/ USA	Nursing	Pediatric course in the Family Nurse Practitioner Programme	The study group (n=20)	Recorded lectures Textbook materials Journal articles Online quizzes	Intensive case studies Role playing Group problem-solving exercises Occasional use of lectures by both peers and faculty	Survey (student perception)
Enfield/2013 / USA	Multimedia	Computer fundamentals for multimedia	The study group (n=50)	Video lectures or assigned readings	Instructor led demonstration of new concepts Instructor led demonstration of concepts previously introduced in videos Open lab time to work on assigned projects Short quiz Small groups activities	Survey (student perception)
Lage et al./ 2000/USA	Economic	Principles of microeconomics	The study group (n=200)	Reading material Video lecture Worksheets	A mini-lecture of approximately 10 minutes if students had questions Economic experiment or lab that corresponded to the topic being covered Worksheets (discussion) and review questions	Survey (student perception) Instructors' perceptions (informal assessment)

Author/Year/ Country	Discipline or sub-discipline	Course	Sample size	Out-of-class activities	In-class activities	Measurement instrument
Love et al./ 2013/ USA	Mathematics	Applied linear algebra	The study group (n=27) The control group (n=28)	Viewing online screencasts Completing a readiness test	Interactive hands on activities	Comparison of student progress in mid-term exams Comparison of final exam grades Student opinion survey
Mason/2013/ USA	Engineering	Control system	The study group (n=20); male (n=16); female (n=4) The control group (n=20); male (n=18); female (n=2)	Video lectures Assigned readings Homework	Individual or group exercises	Survey and class discussion (student perception) Open-ended design problems Content coverage Quiz and exam performance
McLaughlin et al./ 2013/ USA	Pharmacy	Basic Pharmaceutics II	The study group (n=162) The control group (n=153)	Online videos Assigned textbook and background readings	Four active learning exercises 1) Audience response and open questions 2) Pair and share activities 3) Student presentation and discussion 4) Individual or paired quiz Microlecture (2-3 min) as needed	Pre- and post-course survey Final exam grades (the study and control group) End of semester course evaluation scores (the study and control group)
Missildine et	Nursing	Adult health	The study	Viewing pre-	Interactive activities	Comparison of

Author/Year/ Country	Discipline or sub-discipline	Course	Sample size	Out-of-class activities	In-class activities	Measurement instrument
al./2013/USA			group (n=246) The control groups (n=172, n=171)	recorded lectures		examination scores Students' perception survey
Moravec et al./ 2010/ USA	Biology (life sciences)	Introductory biology	The study group (n=795) The control groups (n=438, n=872)	Either a narrated PowerPoint video with a notetaking sheet or a one-page worksheet (a short reading assignment and questions)	An interactive demonstration Clicker questions Problem-based small group discussion, and/ or class discussion	Final exam grades (objective performance test) Survey (student perception)
Pierce and Fox/ 2012/USA	Pharmacy	Renal Pharmacotherapy module within the integrated pharmaceutical care and science series	The study group (n=71); male (n=30); female (n=41) The control group (n= not specified)	Vodcasts (video podcasts)	POGIL activity	Pre-test and post-test (The study group) Final examination questions (The study and control) Survey (student perception)
Smith/2013/ USA	Chemistry (life sciences)	General chemistry	The study group (n=235)	Online homework Pre-recorded	Questions and answers related to the video lecture	Survey (student perception)

Author/Year/ Country	Discipline or sub-discipline	Course	Sample size	Out-of-class activities	In-class activities	Measurement instrument
				lectures	Quiz questions (graded in the second year of trial) Problem solving	
Strayer/2012/ USA	Statistics (formal science)	Introductory statistics class	The study group (n=23); female (n=12); male (n=11) The control group (n=26); female (n=13); male (n=13)	Computer module (an intelligent tutoring system)	Small group activity	Survey (student perception, modified CUCEI) Focus groups and interviews
Tune et al./ 2013/USA	Medicine	Cardiovascular, respiratory and renal physiology	The study group (n=13) The control group (n=14)	Pre-recorded lectures	Quizzes/ written homework assignments Question and answer/ problem-solving exercises	Multiple choice exams Survey (student perception)

2.5 Discussion

This review set out with the aim of examining the efficacy and feasibility of the flipped classroom format used in higher education institutions. All of the literature found on implementing the flipped classroom teaching model was conducted in the USA in different academic settings, which included education of pharmacy, medicine, nursing, biology, chemistry, statistics, economics, mathematics, engineering and multimedia. Ultimately, there is a lack of consensus of what comprises a flipped classroom format. Nevertheless, it is fairly obvious that this model of instruction utilises technology to disseminate the knowledge-based content of the course outside of and prior to the classroom time, allowing the lecturer to use the contact hours in engaging students in various active learning approaches. This concept was incorporated in all of the research studies reviewed. However, variation was found in class restructuring methodologies.

In most studies, pre-recorded lectures were used as a means to deliver the content of the course and as a tool for students to prepare for in-class activities. An intelligent tutoring system was used in one research study to introduce students to the course content outside the classroom. Reading materials and/or worksheets were also assigned in some studies as pre-class preparation. Recorded lectures were incorporated in different forms and lengths in each study. The lecturer either recorded the live lectures of the traditional classroom to be used in the flipped model or created new videos. Recording, editing, and making video lectures accessible to students was deemed as time demanding and it might need support from information technology staff.

Active learning is defined as “the process of having students engaging in some activity that forces them to reflect upon ideas and how they are using those ideas” (Ernst and Colthorpe, 2008, p. 1). Active learning can be attained by engaging students in the learning process through participating in learning activities that require them to consider their understanding and

integrate new information to their personal conceptual framework (Ernst and Colthorpe, 2008).

All of the reviewed studies incorporated some sort of active learning activities during the scheduled class time with the aim to engage students, develop their cognitive skills and improve their performance and attitude. Case-based learning, problem-based learning, POGIL, role-play, pair and share activity, and audience response system and clickers were used as a means to facilitate active learning in healthcare disciplines. Different strategies of active learning such as conducting experiments, working in a lab or on assigned projects were found in non-healthcare majors such as multimedia, economics and engineering. These active learning techniques might best fit with the nature of these major areas.

The new role of the lecturer was similar in most of the reviewed papers. Their responsibilities involved designing video lectures, creating and facilitating in-class activities and providing formative feedback. In one study, class activities were facilitated by a different teaching assistant. The literature found that implementing the flipped classroom is time consuming and needs much preparation before the start of the course. Preparation time, however, declines in subsequent implementation trials as the resources can be updated and reused. The faculty member needs to carefully consider how to integrate the pre-class portion of the course with the in-class activities into a comprehensible whole. Literature findings indicated that a poorly connected flipped model can result in undesirable outcomes.

Students' preparation prior to the scheduled class is a key in the success of the flipped classroom model. In some literature, preparation involved only viewing pre-recorded video lectures. In others, in addition to the video lecturers, students had to complete reading materials and/or worksheets. Online quizzes were also required to be completed by students before coming to class in one study. Some studies incorporated a motivator in order to encourage students to complete the pre-class tasks. Motivators found in the literature included providing students with guidelines, allocating bonus

marks for completing the assigned materials, pre-class readiness test, graded quizzes and graded worksheets. Flipped classrooms, however, were successful in other studies despite not including a motivating element in their design. Thus, the effect of adding a motivator on students' preparation for the class remains questionable.

Among the reviewed studies, only seven are comparative, examining both students' perception of the flipped classroom and their academic performance. One comparative study assessed student perception only. The remaining were non-comparative studies that explored students' perception of the flipped classroom approach. Lecturer perception of the flipped classroom model was investigated in one research paper by direct lecturer observations. Students' performance in the flipped classroom was measured by comparing exam scores with the control group. Pre- and post-test comparison was also made in one study. Students' perception of the flipped classroom format was determined by a survey instrument. One study also utilised a class discussion in addition to the survey to assess the perception of students.

Findings from studies that assessed both students' academic achievement and satisfaction showed that students fell into one of the following categories: performed similar to or better than students in the traditional lecture format and satisfied (*n*=2); performed better than the traditional class and satisfied (*n*=4) and performed better than the traditional class and less satisfied (*n*=1). The majority of studies (n=4) undertaken to assess only student perception of the flipped classroom showed that students were satisfied. However, one study found that students were unsatisfied with this new approach as they found it challenging to connect the online and face-to-face parts of the flipped classroom paradigm. Those students were first- or second-year undergraduates taking an introductory statistics course. This finding might question the feasibility of using the flipped classroom in introductory courses taught to first- or second-year undergraduate students.

Overall, the reviewed research studies have a number of limitations that affected the generalisability and external validity of the results. Firstly, the scope of the studies was limited to the investigated subject areas. Therefore, extrapolation of these results to other subjects is not necessarily achievable. Secondly, all of the reviewed studies were conducted in the USA. Thus, different results might be achieved if studies are conducted in other geographic areas. Additionally, lack of randomisation of participants and the existence of a substantial amount of confounding variables in this educational research make generalisation to a wider population unattainable.

It was also noticed that power calculations were performed only in Missildine and colleagues' study (2013). Therefore, sample size was not justified in all other reviewed comparative studies, and the sample size might not be large enough to detect any statistical difference between the study and the control group. Another limitation spotted in most of the reviewed literature is a lack of evidence on the reliability and validity of the survey instrument used to examine student perception. However, Missildine et al. (2013) and Pierce and Fox (2012) used a survey instrument with good internal consistency reliability. Additionally, Strayer's (2012) survey had an acceptable internal consistency reliability.

It can be seen that this innovative teaching approach was implemented in diverse academic years of graduate and undergraduate education. However, four studies (Enfield, 2013; Missildine et al., 2013; Moravec et al., 2010; Smith, 2013) have failed to provide information on this aspect. Missildine et al. (2013) and Moravec et al. (2010), however, have reported information about the mean age of participants, which was missing in all other reviewed papers. This piece of information is essential in examining whether the flipped classroom is best applied to a particular age group of students.

From the literature reviewed above, the existing flipped classroom model of instruction can be divided into two main phases: before-class and in-class. The before-class phase is used to assist in dissemination of new knowledge outside and prior to the classroom time with the aid of technology. In this

phase of the flipped classroom paradigm, the lecturer provides students with the traditional lecture content mainly in a form of pre-recorded online lectures or by using an intelligent tutoring system. Recording, editing and uploading online lectures can be a time burden and might require assistance from the information technology department. However, online lectures can be updated and reused over and over again. The lecturer could also assign reading materials, worksheets and online quizzes. What is more, the lecturer has to create and prepare for interactive in-class activities. Students, in turn, are responsible for preparing for the scheduled class by viewing the online lecture and completing any assigned tasks.

In class, students participate in the learning process through diverse interactive activities under the guidance of a faculty member. Interactive activities allow students to reinforce their knowledge of the topic being covered. Additionally, students work in groups, thus interacting more with their peers and teacher. The facilitator guides students, provides them with a formative feedback, and fills any gap and corrects misconceptions in their learning. Motivating students to prepare for the in-class activities can be achieved by different ways such as assigning graded quizzes or worksheets or allocating bonus marks for completing assigned tasks.

The flipped classroom teaching paradigm was assessed by different methods such as examining students' perception and satisfaction, students' academic achievement and lecturers' opinion. Students' perception can be determined by administering students an end of course survey instrument, pre- and post-course survey, undertaking in-class discussion, one-to-one interviews, and focus groups. Pre- and post-tests, and comparing course grades with the control group are possible ways to measure students' academic performance. Direct observation was used in the literature to determine lecturers' perception of the flipped classroom instructional model.

The evidence for the flipped classroom's effectiveness is as follows: firstly, recorded lectures enable self-paced learning as students can benefit from going through the content at their own pace and as often as they need.

Secondly, the flipped classroom was found to have no negative impact on student academic performance. What is more, the evidence showed that the flipped classroom is engaging, improves student-educator interaction and can make students socially more comfortable. Finally, this innovative teaching approach was found to help students adopt a deeper approach to learning and therefore prepare them well for assessments.

However, the flipped classroom is not without challenges and shortcomings. The above reviewed studies indicated that the flipped classroom could be burdensome on both students and educators. To illustrate this further, implementing the flipped classroom requires educators to prepare learning activities for both the pre-class phase and the in-class phase. The literature also revealed that the flipped classroom needs a thoughtful design with careful sequencing of learning activities. In addition, the quality of the online lecture needs to be ensured if it is used to deliver the off-loaded content. Due to the unique requirements of the flipped classroom, students are expected to complete independent learning before turning up to the scheduled class. Pre-class preparation may increase students' workload especially in the presence of other course commitments.

The traditional lecture, on the other hand, does not require students to complete any preparatory work before attending the class. It only requires the educator to prepare for the teaching that will in turn be delivered to students during the class time. However, pacing the delivery of the traditional lecture content considering the diversity of students and subject delivery is not attainable. In addition, lectures that lack interactive components trigger students' disengagement with the learning.

Given the above considerations, when implementing the flipped classroom approach to replace the traditional lecture, there will be an increase in the resources needed. For instance, information technology support might be required for creating online learning activities. Equally important, academic staff might also require professional development opportunities to assist in understanding pedagogical concepts and therefore effective design and

implementation of the flipped classroom. Consequently, the cost and time required for the flipped classroom could be higher than for the traditional lecture approach.

Much of the research on the impact of the flipped classroom up to now has been descriptive in nature as their argument about students' perception was heavily dependent on quantitative methods for data collection and analysis. In addition, none of the reviewed literature was informed by a theoretical perspective. This review underlines the need for further research into the efficacy of the flipped classroom instructional model in pharmacy education. Additionally, studies need to be conducted using more valid and reliable assessment techniques. Furthermore, there is a need for studies that employ both quantitative and qualitative approaches for data collection and analysis with interpretations guided by an appropriate theoretical framework such as adult learning theory. This would be more informative and provide a deeper understanding of students' perceptions and experiences. In addition, it would enable strategies to be recommended for implementing a flipped classroom based on a theoretical approach.

2.6 Chapter summary

This literature review explored the flipped classroom instructional model used in higher education. Despite a lack of agreement on what constitutes a flipped classroom, all researchers described the same concept which frees up the class time for more engaging activities. This approach has generally shown promising results in various disciplines. However, in some research, students were found to be dissatisfied with the flipped classroom approach. Due to bias and limitations of this review, results cannot be extrapolated to different settings or a wider population. Therefore, further studies on this teaching approach are needed to understand the application to pharmacy education. In addition, there is a need for further studies that employ mixed methods approaches for data collection and analysis, as this would allow for in-depth understanding of the subject under the study.

Chapter 3 Methodology

This chapter describes the methods undertaken to achieve the aims and objectives of this research. It starts by presenting the preliminary fieldwork that was conducted in the early stages of this research programme. It then goes on to present the research paradigm, the study design and the rationale for the chosen method, participants, the procedures of data protection and ethical considerations, the data processing and analysis, and finally it discusses the validity and reliability of the research.

3.1 Preliminary fieldwork

3.1.1 Aim of preliminary fieldwork

The preliminary fieldwork had the following main aims:

- To discuss the practicality of conducting the study at UCL School of Pharmacy, and the School of Pharmacy and Biomedical Sciences at University of Portsmouth, and to inform on suitable methods for intervention, data collection and recruiting participants.
- To gain insights into the facilities available at both pharmacy institutions.
- To discuss the potential topics for the experimental study and recruit a lecturer at both pharmacy schools to deliver the teaching for the full-scale study.
- To discuss the feasibility of running a pilot flipped-style teaching session with a group of MPharm students at UCL School of Pharmacy.

3.1.2 Meeting with the E-learning coordinator at UCL School of Pharmacy

Two meetings were arranged with the E-learning coordinator at UCL School of Pharmacy (UCL SOP) to discuss the available e-learning tools that can be used in implementing a flipped classroom. The following are the main points that arose from the meetings:

1. UCL SOP has a subscription to Camtasia® which is a screen recorder and a video editor software.
2. There is one lecture theatre at UCL SOP fitted with fixed TurningPoint keypads. TurningPoint is a student response technology that enables educators to pose a question to students and students respond with TurningPoint keypads or web-enabled mobile devices (TT, 2017).
3. UCL SOP has 100 spare TurningPoint buttons that can be requested and used in any teaching space.
4. Moodle has a wide range of functions for creating online quizzes such as interactive and formative quizzes. Moodle is a virtual learning platform that provides educators, administrators and learners with a single robust, secure, and integrated system to create personalised learning environments (Moodle, 2016).
5. The E-learning coordinator can provide one-to-one training/support for using the different tools at UCL SOP.

3.1.3 Meetings with the pharmacy practice academics at the UCL School of Pharmacy

Several meetings were organised with the Clinical Pharmacy Teaching Lead for the MPharm, and the Lead for year four MPharm Preparation for Practice module. The discussions involved the initial methodological plan for the flipped classroom study, and how this would fit into the MPharm programme in terms of the year group and the specific module. In addition, the following matters were also discussed: the potential subject areas, the logistics of running the sessions and how would these fit with what is already being taught in the rest of the year, availability of students for a pilot flipped teaching session and for focus groups, and how to recruit them for the focus groups.

3.1.4 E-mail discussions and meetings with the pharmacy practice academics at Portsmouth School of Pharmacy and Biomedical Sciences

E-mail discussions initially took place with some of the senior pharmacy practice staff to discuss the logistics of repeating the UCL's plan at University of Portsmouth. This was followed by two visits to the Pharmacy Practice Department at Portsmouth School of Pharmacy and Biomedical Sciences and meetings with key staff members. These discussions highlighted a number of ethical considerations and concerns about the facilities, from which the design of the study experiment emerged. These issues are illustrated in section 3.1.5. It was found that at UOP School of Pharmacy, each student is given a TurningPoint keypad to keep during the MPharm programme therefore it could be brought to any teaching session.

3.1.5 Impact of preliminary fieldwork on the development of the study

The preliminary fieldwork assisted in designing the structure of the study experiment, and making the necessary plans to successfully run the teaching sessions taking into account any ethical consideration. Additionally, it helped in deciding on a year group from the MPharm programme and a topic area, and recruiting a lecturer at both institutions.

The following decisions were made, and the proposed protocol was amended accordingly:

1) To conduct the study on year four of the MPharm programme since this group of students have gone through different teaching and learning approaches.
2) To choose a topic that is independent of the core topics (not examinable), since allocating students to learn examinable materials by random selection of a teaching method could potentially create unequal opportunities in learning. Management of rheumatoid arthritis was selected accordingly.

3) To create and use a formative assessment of knowledge since the chosen topic is non-examinable.
4) To run a pilot flipped-style teaching session to year four MPharm in March 2015.
5) Two slots of two hours each were booked in the year four MPharm at both pharmacy institutions for the academic year 2015-2016. The slots were one week apart to allow the traditional lecture to be delivered first, followed by the flipped classroom.

3.2 The research paradigm

The constructivist paradigm is typically considered as an approach to qualitative research (Creswell, 2014). It assumes that human beings construct meanings as they engage with the world they are interpreting (Creswell, 2014; Crotty, 1998). Individuals develop various and multiple subjective meanings for their experiences (Lincoln and Guba, 1985). Thus, constructivist researchers often use open-ended questions to encourage the participants to share their opinions and experiences (Creswell, 2014). Constructivism also claims that individuals engage with their world and make sense of in in accordance with their historical and social perspectives. Therefore, qualitative researchers tend to visit the context or setting of the participants and collect information personally to understand this context. Interpretation of the researcher's findings is shaped by his/her own experiences and background. For that reason, reflexivity needs to be addressed in qualitative research. Another assumption in the constructivist paradigm is that the basic generation of meaning is always social resulting from interaction with a human community (Creswell, 2014; Crotty, 1998). Thus, qualitative researchers generate or inductively develop a theory or pattern of meaning instead of starting with a theory (Creswell, 2014).

Unlike the constructivists, positivists and post-positivists believe that only one reality exists (Creswell, 2014; Robson, 2011). However, the positivist paradigm assumes that objective knowledge can be obtained through direct experience or observation. Post-positivists, on the other hand, claim that

evidence in research is always imperfect and fallible as theories, hypotheses, background knowledge and values of the researcher can influence what is observed (Robson, 2011). These worldviews represent the traditional form of research and their assumptions reflect quantitative research more than qualitative research (Creswell, 2014).

Pragmatism is another philosophical position that focuses on the research problem and uses all approaches available to understand the problem. This paradigm underpins mixed methods research that enables the utilisation of multiple methods, different worldviews, different assumptions and various forms of data collection and analysis (Creswell, 2014). The research presented in this thesis is based on the pragmatic worldview that involved using both constructivist and positivist worldviews.

3.3 Study design and rationale for the chosen method

The design chosen to conduct this study is a quasi-experimental, mixed methods design. This study followed a particular format of the quasi-experiment, which is the post-test non-equivalent control and experimental group design. In this design, participants are allocated into a control group and an experimental group without random assignment. The intervention is delivered to the experimental group, and the two groups are given a post-test (Creswell, 2014). Because of the nature of this educational research, it was not possible to conduct a true experiment due to the unfeasibility of randomly assigning participants to control or experimental groups (Cohen et al., 2011). The experiment was conducted at the University of Portsmouth first, and then the same work was replicated at University College London. In this experiment, the participants were allocated into a lecture group and a flipped classroom group. The two groups were given a formative test measuring knowledge acquisition and a survey measuring students' satisfaction and their learning styles. The independent variables are: the teaching method (flipped classroom or traditional lecture) and the learning style (diverging, assimilating, converging, accommodating). The dependent variables are: student satisfaction and knowledge acquisition.

A quantitative research approach can be adopted in survey research to study a sample of a population and provide a numeric description of phenomena such as participants' attitudes or opinions. It could also be utilised to determine the influence of a specific treatment on a particular outcome such as in experimental research and also to examine relationships among variables of interest (Creswell, 2014; Robson, 2011; Smith, 2010). Researchers adopting this approach commonly seek to generalise the findings to a wider population (Robson, 2011). A qualitative research approach, however, is thought to be appropriate for answering 'how?' and 'why?' questions which may be employed to explore processes and patterns in thoughts and behaviour. Qualitative studies explore the views of individuals in detail, frequently with a small sample of carefully selected participants. Thus, qualitative research is usually exploratory and helps to explain participants' thoughts, experiences and attitudes (Smith, 2010).

Mixed methods research is defined as a branch of research that involves combining quantitative and qualitative research approaches into a single study (Johnson and Onwuegbuzie, 2004, p. 17). This distinct research approach has gained tremendous popularity over the last decade (Bryman, 2008). Traditionally, researchers would use different terms for labelling this approach, such as multimethod, quantitative and qualitative methods, mixed methodology and integrating (Creswell, 2014). The purpose of mixed methods research is to yield research that is superior to mono-method studies by drawing from the strengths and minimising the weaknesses of single quantitative or qualitative research (Johnson and Onwuegbuzie, 2004). In addition, the mixed methods approach could be used for an explanatory purpose in which qualitative research is conducted to further explain initial quantitative data results. Furthermore, this approach is applicable for designing a quantitative data collection instrument by conducting exploratory qualitative research first (Creswell, 2014). The research presented in this thesis adopted a mixed methods approach; the mono-quantitative and qualitative approaches were rejected for a number of reasons. Firstly, the quantitative approach will enable the impact of the

flipped classroom method on students' satisfaction and knowledge acquisition to be examined. Secondly, it will allow the association between variables of interest, such as learning style and satisfaction, to be investigated. In addition, the qualitative approach was adopted to perform an in-depth exploration of students' views on teaching and learning methods in both stages of this research.

The design employed in this research is 'embedded mixed methods' design which nests either quantitative or qualitative data or both within a larger study design such as an experiment. In addition, this involves either merging quantitative and qualitative data to produce a comprehensive analysis of the research problem or using the data sequentially for explanatory or exploratory purposes (Figure 3.1) (Creswell, 2014). To illustrate this further, the research presented in this thesis was conducted in two stages: the first stage (academic year 2014/2015) involved a qualitative study investigating MPharm students' attitudes towards different teaching and learning approaches; the second stage (2015/2016) involved conducting a quasi-experimental study that employed a mixed methods approach to investigate the impact of the flipped classroom teaching method quantitatively and qualitatively on undergraduate pharmacy students. The data from each stage was analysed separately, and the findings were integrated and discussed in the overall discussion chapter (Chapter 8). Developing the intervention for stage II was informed by stage I qualitative findings (Chapter 5).

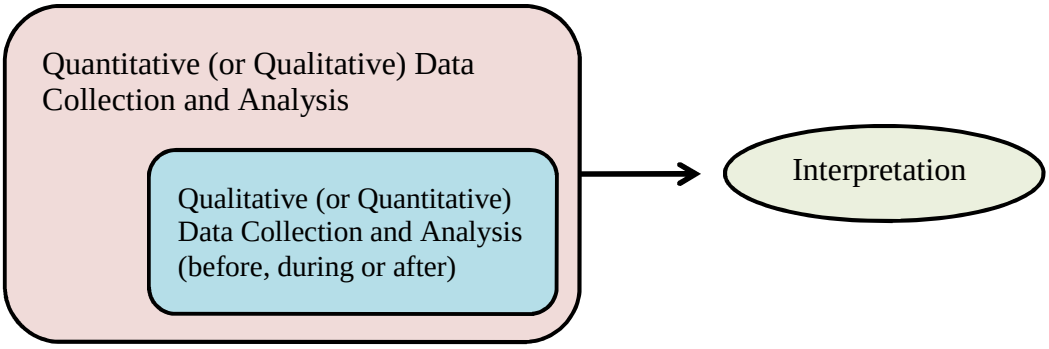

Figure 3.1: Embedded Mixed Methods Design (Adapted from Creswell (2014, p. 221)

Focus groups were chosen as the most appropriate qualitative approach to meet the aims and objectives of the qualitative phases (Chapter 4 and Chapter 6). Focus groups are group interviews with a small number of people conducted by an interviewer, normally called a facilitator, who uses an interview schedule or topic guide to encourage participants to talk to each other in focusing on a topic of interest (Bowling, 2009; Smith, 2010). Although individual interviews may produce more detailed responses than focus group interviews with the same number of individuals, focus groups can yield a large amount of data in a short period of time (Cohen et al., 2011). Additionally, the interaction between participants that occurs in focus groups may stimulate a wide-ranging discussion and generate ideas, thus pursuing a topic in greater depth (Bowling, 2009; Smith, 2010). Although focus groups have certain strengths, there are a number of limitations associated with this approach. First, some participants may be reluctant to express opposing viewpoints. Second, some individuals may dominate the discussion and subsequently the results might not represent the views of all participants. Third, some participants may change their viewpoints when hearing the argument of others. These challenges are not encountered in the individual interviews approach, which could also be adopted to discuss personal or sensitive issues (Smith, 2010). However, due to the limited timeframe of this research and in order to achieve an in-depth discussion, the individual interviews approach was rejected.

For this study, a semi-structured topic guide was adopted to aid in conducting the focus groups. This instrument was selected because it involves open-ended questions with a number of probing questions to ensure that all aspects of the topic are covered and all participants have an opportunity to share their views (Smith, 2010). Refer to Figure 3.2 for the overview of the study design.

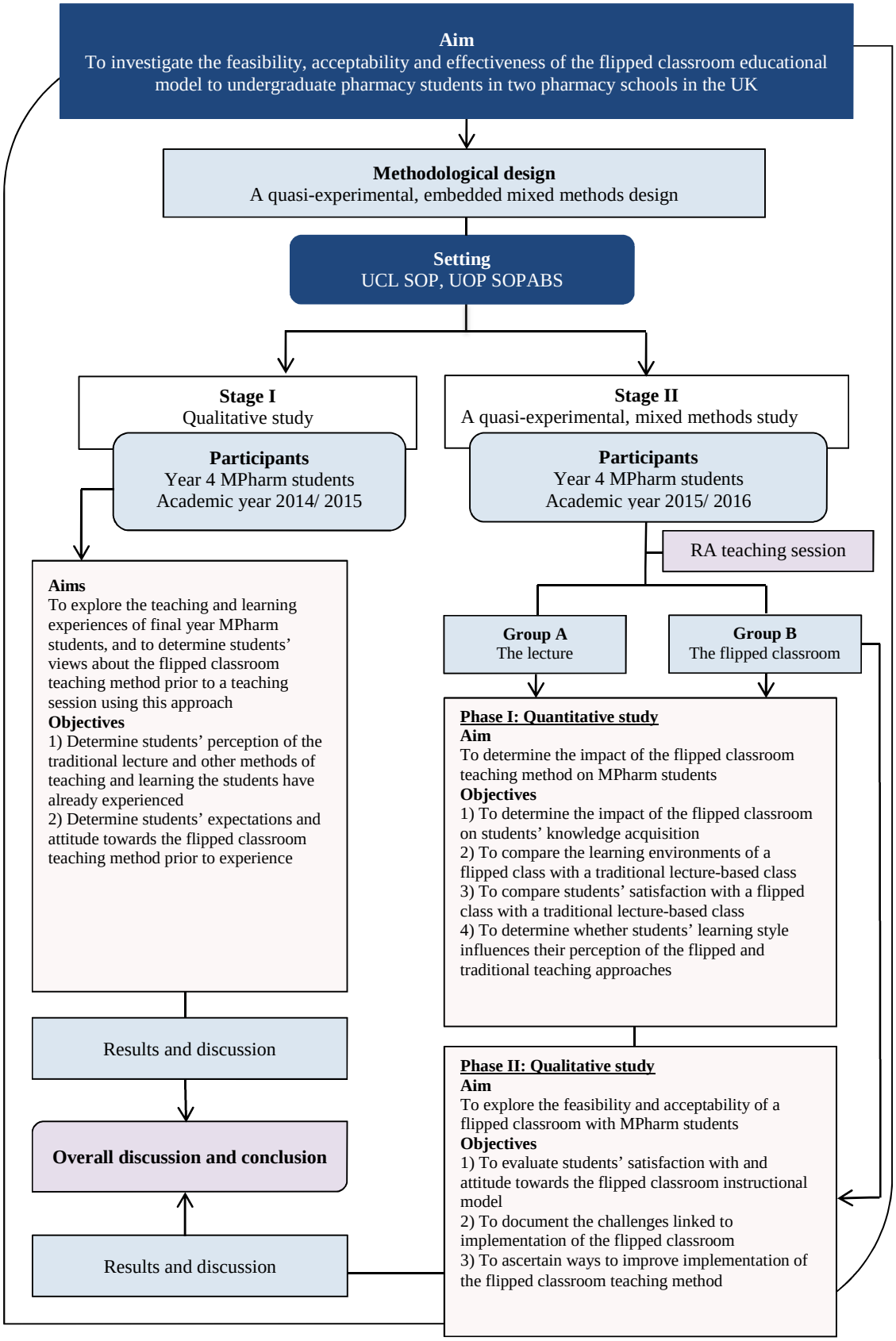

Figure 3.2: Overview of the study design

3.3.1 Monitoring intervention fidelity

Intervention fidelity is described as the extent to which key elements of an intervention were implemented as intended (Dane and Schneider, 1998; Horner et al., 2006; Murphy and Gutman, 2012). Thus, adherence to the intervention design is a key to preserving the internal validity (Horner et al., 2006). Different strategies could be incorporated into a study design in order to measure and enhance implementation fidelity. Those include the provision of detailed intervention manuals, providing training to interventionists and supervising intervention sessions (Dane and Schneider, 1998; Horner et al., 2006; Murphy and Gutman, 2012).

The training on delivering the intervention should cover the philosophy of the intervention, details of the intervention objectives and procedures. Additionally, the skills necessary for implementing the intervention can be practised. Investigators can also assess implementation of an intervention by supervising the intervention session. This could be assisted by taking notes, using check lists and audio-tape recording the sessions (Horner et al., 2006).

In this research, the interventionists were qualified teaching practitioners with plenty of experience in running teaching sessions in a traditional and a workshop format, but they had never delivered teaching in the flipped classroom model. This intervention research incorporated interventionist guidance, preparing standardised lecture notes, detailed lesson plan and monitoring the intervention sessions. Guidance on implementing the intervention was provided in the form of one-to-one meetings with the lecturers. In addition, the researcher provided assistance by making the necessary arrangements and facilitating the experimental procedures. Intervention implementation was examined by the principal researcher supervising the teaching sessions, which was assisted by note taking.

3.4 Participants

3.4.1 Study Setting

This research took place in two different pharmacy institutions in the UK that offer an accredited MPharm programme: UCL School of Pharmacy and the School of Pharmacy and Biomedical Sciences at Portsmouth University. The research was carried out during the academic years 2014/2015, and 2015/2016. The two pharmacy schools were opportunistically recruited to participate in the study due to already established links.

UCL School of Pharmacy (formerly The School of Pharmacy, University of London) is located in the heart of London, England. This pharmacy institution merged with UCL in January 2012 to form the UCL School of Pharmacy (UCL, 2017b). According to the Times Higher Education (2016), UCL was rated the fourth in the UK, and the fifteenth in the world. The School of Pharmacy and Biomedical Sciences at Portsmouth University is situated in the centre of Portsmouth, on the south coast of England (UOP, 2017). University of Portsmouth was rated fifty-second in the UK rankings, and is one of the top 500 universities in the world (Times Higher Education, 2016).

3.4.2 Populations and samples

Population refers to all the cases that the study is about (Robson, 2011; Smith, 2010), and in the current research the population was all students attending the MPharm programme at UCL and UOP. A sample is defined as a selection from the population (Robson, 2011). Research studies commonly involve a sample of cases rather than a whole population, and this requires a decision on a sampling strategy and sampling procedures. The sample strategy is the approach used to identify the type of sample needed for the study, whereas the sampling procedure is defined as the approach used for identifying and selecting individuals or cases. Choosing the sampling strategy is dependent on the aims of the research. A probability sample or a representative sample is commonly used if drawing generalisations from the findings to the entire study population is necessary. Simple random sampling is considered the gold standard for selecting a representative sample in

which all cases in the population have an equal chance of being selected. Purposive sampling is common in qualitative research and it involves the identification of cases that meet certain criteria or have a particular experience. A convenience sample is another common sampling strategy that involves individuals or cases that are accessible and ready to participate. The current research utilised a purposive sampling approach in which a small number of individuals with a particular experience were targeted (Smith, 2010). However, the above-mentioned sampling strategies were rejected as participants needed to be deliberately selected because of the need to fulfil certain conditions.

3.5 Data protection and ethical approval

Ethical issues were considered for this research project, and all data was collected and stored in accordance with the Data Protection Act 1998. Personal data, i.e. student identification numbers, were requested in the teaching sessions' survey; therefore, it was necessary to register this study with the UCL Data Protection Officer (See Appendix 2: UCL Data Protection Registration Form).

Participation in the study was voluntary and participants had the right not to take part in the research. Anonymity and confidentiality of participants was ensured. Potential participants were given an information sheet that explained the purpose of the study, what was involved in participation, and how the data would be collected and handled. Participants who agreed to participate were asked to sign a written consent form. In order to avoid bias, the teaching sessions were delivered covertly prior to survey administration and data collection. Covert research refers to research that is not disclosed to the study participants. In other words, the researcher does not reveal to participants that research is being conducted (Spicker, 2011). One of the main reasons for limiting disclosure is to avoid behavioural changes of the participants that could invalidate the research (Robson, 2011; Spicker, 2011).

The information provided by participants would not be disclosed in any way that might identify an individual or that might enable an individual to be

traced. In addition, participants will not be discussed with anybody else. Identifiers from the data released on individuals were deleted.

Audio-recorded focus group interviews and the returned surveys were locked in a storage cabinet at UCL School of Pharmacy and were only accessible by the research team. Pseudonyms were given to all interviewees when transcribing the focus group discussions. Electronic personal data was stored on a password-protected UCL computer. The collected data will be destroyed after the completion and publication of the research project.

3.5.1 Application for ethical approval

Ethical approval for this educational research was sought from UCL's research ethics committee. Collaborating departments at both pharmacy institutions were informed about the study and agreed to participate, and correspondences were attached to the ethics application form. The form was submitted to the committee on the 25th November 2014, and this was approved on the 4th December 2014 (refer to Appendix 3: UCL Ethics Approval Letter). An extension to the ethical approval was requested on the 14th December 2015 (see Appendix 4: Amendment Approval Request Form).

3.6 Data processing and analysis

3.6.1 Data processing and analysis in qualitative research

The approach to data processing and analysis is influenced by the study objectives. The goals of qualitative studies may range from generating theories or hypotheses to explain phenomena of interest, to providing a comprehensive description of respondents' views or experiences with respect to particular situations or events. These goals will guide in choosing the best approach to collecting, processing and analysing the data (Smith, 2010). In the present qualitative research, the researcher employed a thematic analysis approach for answering the research questions. Qualitative approaches are very complex and variable, and thematic analysis is considered a foundational method for qualitative analysis. It provides the

skills necessary for conducting other qualitative analytic methods. Therefore, “thematising meanings” is seen as a generic skill that is shared across different qualitative approaches (Braun et al., 2006). Other qualitative analytic methods include interpretative phenomenological analysis (IPA), grounded theory and pattern-based discourse analysis. IPA is concerned with how people make sense of their lived experience, whereas grounded theory focuses on building theory from data with an emphasis on understanding social processes. Identifying patterns in language use that are connected to the social production of reality, and with an understanding of how accounts of objects and events are constructed in particular ways is the key feature of pattern-based discourse analysis (Braun and Clarke, 2013). The other qualitative analytic methods mentioned above were eventually rejected for two reasons. Firstly, the current qualitative research did not aim to generate theory from the data. Secondly, the emphasise was not on how participants make sense of their lived experience, nor did the study aim to identify patterns in language use.

Thematic analysis is a flexible method that can be applied across different theoretical and epistemological approaches (Braun et al., 2006). In other words, this analytic method does not specify particular methods of data collection, theoretical positions, epistemological or ontological frameworks (Braun and Clarke, 2013). In thematic analysis, themes or patterns can be identified in an inductive or ‘bottom-up’ way, or in a deductive or ‘top-down’ fashion. In the inductive approach, the data is analysed with little or no predetermined theory or framework, so the analysis is data driven. Conversely, the deductive approach involves fitting the data into a predetermined framework or the researcher’s analytic preconceptions to explore particular theoretical concepts (Braun et al., 2006; Burnard et al., 2008). In this study, the researcher adopted a combined approach of both deductive and inductive thematic analysis (Braun and Clarke, 2013; Smith, 2010). To explain this further, themes were identified on the basis of what is in the data. In addition, the data was used to explore particular theoretical

ideas (Braun and Clarke, 2013). Refer to **Figure 3.3** for the stages followed in this study for conducting a thematic analysis.

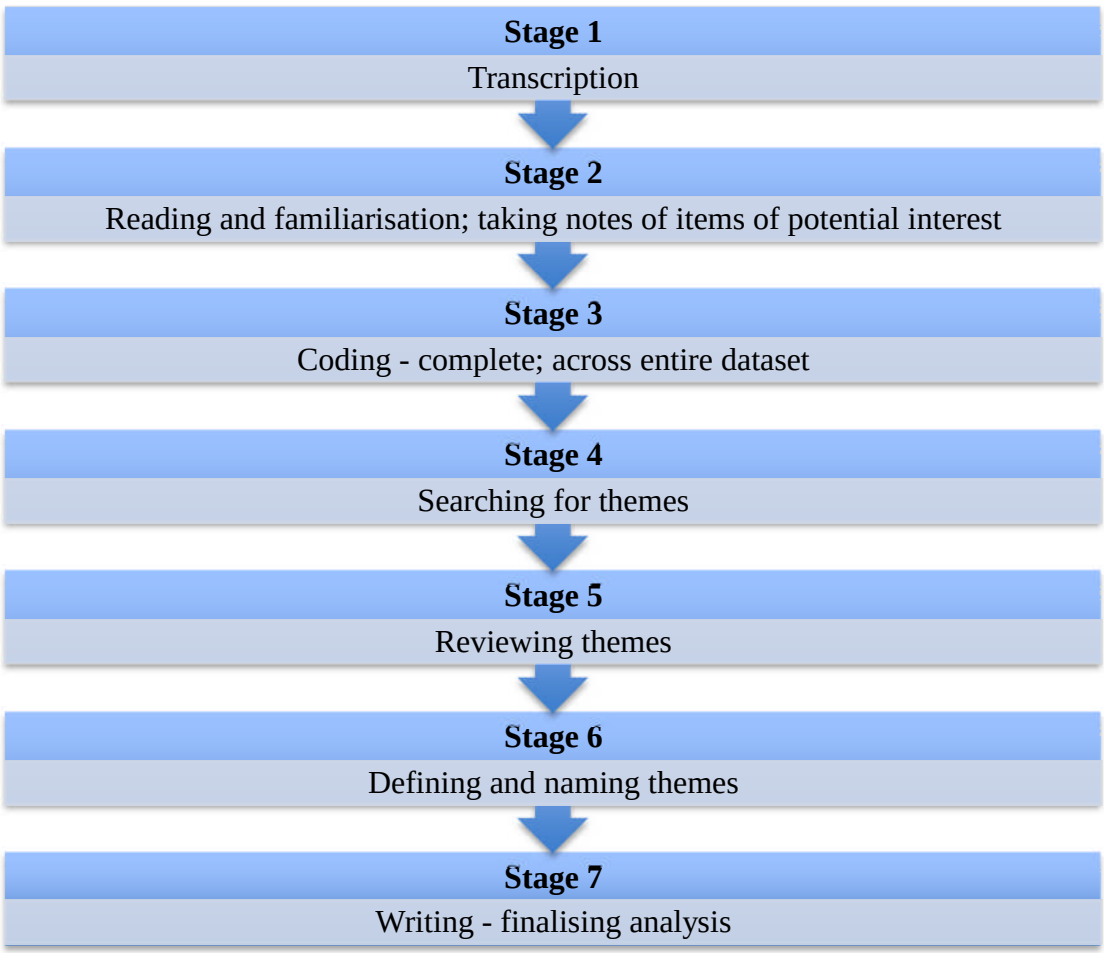

Figure 3.3: Stages of Thematic Analysis (Adapted from Braun and Clarke, 2013: 202)

3.6.1.1 Transcription

Verbatim transcription of the audio data is the first stage in the data processing and preparation of data for analysis in qualitative research (Braun and Clarke, 2013; Burnard et al., 2008; Smith, 2010). Transcribing data is time consuming and it might take about an hour to transcribe four to five minutes of data from a focus group. However, this task often takes a little longer, especially for an inexperienced transcriber (Braun and Clarke, 2013).

One exception to the verbatim transcription of the audio data relates to ensuring the anonymity of the participants by changing their names and the names of others mentioned in the data by giving them a pseudonym (alternative name) (Braun and Clarke, 2013). All focus group discussions were transcribed by the principal researcher herself; this also helps data analysis by enabling the researcher to begin to become immersed in the data. In order to ensure accuracy of the transcribed data, the project supervisors examined and conducted accuracy checks on the produced transcripts against the original audio recordings.

3.6.1.2 Computer Assisted Qualitative Data Analysis Software (CAQDAS)

A number of computer software packages have been developed to assist in managing large amounts of qualitative datasets (Smith, 2010). The packages act as an online filing system that allows for a comprehensive and systematic approach to data coding and analysis (Braun and Clarke, 2013; Burnard et al., 2008; Smith, 2010). Using such packages enables quick searching for codes and data, and making visual connections. Additionally, these packages could enhance the rigour of qualitative coding and analysis by providing reassurance about the comprehensiveness of coding (Braun and Clarke, 2013). For the above-mentioned reasons, NVivo for Mac version 11.0.0 was used to store, code, and manage focus groups transcripts.

3.6.1.3 Familiarisation and data coding

Once the data has been transcribed and prepared for analysis, immersion in the collected data is the next step in analysis of qualitative data. In this phase, the researcher familiarised herself with the content of the dataset by repeatedly reading the data and searching for meanings and patterns. The generated ideas were kept on hard copy notes and formed the initial blocks for data coding (Braun and Clarke, 2013; Robson, 2011).

Coding refers to the process of examining data and identifying aspects of it that are relevant to the research question. Coding can be selective or complete; each approach serves a particular purpose. Selective coding tends

to identify and select a corpus of instances of the phenomenon in which the researcher is interested. This approach to coding is widely used for discursive, narrative and conversational approaches to analysis. In this qualitative study, the researcher conducted a complete coding in which all data that was relevant to answering the research question was identified and coded (Braun and Clarke, 2013).

3.6.1.4 Identifying patterns across data

This stage was commenced once the initial coding had been completed. It involved sorting different codes into potential themes and putting together all the relevant coded data extracts within the identified themes (Braun et al., 2006; Robson, 2011). A theme is “a patterned meaning across a dataset that captures something important about the data in relation to the research question, organised around a central organising concept” (Braun and Clarke, 2013: 337). The identified themes were provisional and repeated revision and revising of the candidate themes was conducted. The purpose of this stage was to ensure that the candidate themes fit well with the coded data and the collected dataset (Braun and Clarke, 2013).

3.6.1.5 Analysing and interpreting patterns across data

The last two stages of the thematic analysis approach involved defining each theme, and writing a narrative that told a story about the content and meaning of the data. This was supported by vivid and compelling data extracts (Braun and Clarke, 2013).

3.6.2 Data processing in quantitative research

Collation of all questionnaires and data collection instruments for coding is the first step in the processing of quantitative data. This is followed by the development of a coding frame that consists of specific codes for all variables. In the present study, the data was coded in accordance with the coding frame and then entered into SPSS spreadsheet (Smith, 2010).

Data cleaning or checking the dataset for errors made during data entry is a critical step in quantitative research (Robson, 2011). Data quality assurance involves checking the dataset for completeness, accuracy and consistency. Data quality assurance in the current quantitative research was conducted by checking the data of a random sample of the returned questionnaires (10%, n=17) against the dataset. No errors were detected at this stage, so the overall data quality was considered acceptable (Cohen and Posner, 2000).

Identifying and documenting the extent of the missing data is a critical step in quantitative data analysis. A traditional approach for entering missing data is to fill in the missing values with arbitrary numbers such as “999”, “99” or “88”. However, this approach is not recommended since it can lead to errors in some statistical procedures. The alternative recommended method is simply to leave the missing values as blank cells (Sainani, 2015). In the present study, missing data was left blank and the approach taken to dealing with missing data is available case analysis or pairwise deletion. In this method, the entire dataset is used and cases are deleted on an analysis by analysis basis depending on where missing data lies (Peugh and Enders, 2004).

3.6.2.1 Analysis of quantitative data

Quantitative data analysis was conducted on the student survey and the formative assessment using the Statistical Package for the Social Sciences (SPSS) version 20.0 for Mac. Descriptive and inferential statistics are the two main branches of statistical analysis. Descriptive statistics are concerned with describing and presenting the data without attempting to infer or predict population parameters, e.g. frequency, mean, mode and median. By contrast, inferential statistics attempt to make inferences and predictions about the population based on the data gathered, e.g. difference testing, correlations and multiple regression (Cohen et al., 2011).

The choice of the best statistical procedure is influenced by the level of data (nominal, ordinal or interval/ratio) and its distribution (normal or non-normal) (Smith, 2010). Parametric data refers to that which assumes knowledge of the characteristics of the population and forms a ‘bell’-shaped distribution

when plotted out, e.g. height, weight and blood pressure. Non-parametric data, on the other hand, makes no assumption about the population, often because the characteristics of the population are unknown (Cohen et al., 2011; Field, 2015; Smith, 2010). It is claimed that, in practise, interval and ratio data are considered to be parametric, whilst nominal and ordinal data are considered to be non-parametric (Cohen et al., 2011).

Descriptive statistics were used to summarise the characteristics of the survey participants. Frequency tables were used to highlight the difference in demographic information of the participants in each group. Bar charts were used to summarise the learning styles of the students and the first languages of non-native English-speaking participants. Additionally, they were used to illustrate students' engagement with the pre-flipped classroom independent learning.

In addition to the descriptive statistics, the following statistical tests were employed on the dataset to measure differences between the intervention and the control groups:

Mann-Whitney U test

The Mann-Whitney test is a non-parametric equivalent of the *t* test for two independent samples (Cohen et al., 2011; Hinton et al., 2014). A non-parametric test is used when the following assumptions of the *t* test are not met: the data must be interval, and the samples come from normally distributed populations, with equal variances. The Mann-Whitney test is commonly used when the data is ordinal, such as in a rating scale (Hinton et al., 2014). The Mann-Whitney test ranks the data and analyses the ranks by comparing the frequencies; a score from one of the samples is ranked higher than a score from the other sample (Cohen et al., 2011; Hinton et al., 2014).

In the current quantitative study, a Mann-Whitney test was employed on the following: to compare the rating of the domains of the CUCEI for the lecture and flipped classroom group, to compare the overall session rating for the

two groups, and to compare the overall session rating for the students who prepared and those who did not prepare for the flipped classroom.

Kruskal-Wallis test

The Kruskal-Wallis test is a non-parametric equivalent of analysis of variance for three or more independent samples (Cohen et al., 2011; Hinton et al., 2014). This test works in a similar way to the Mann-Whitney test, i.e. based on ranking. It enables us to test for differences between three or more groups on a rating scale (Cohen et al., 2011).

This test was employed to test for differences in the overall session rating between the four categories of learning styles: accommodating, diverging, converging and assimilating, within each session group.

Chi-square test

The Chi-square statistical test allows the analysis of data frequency, which is often presented in a frequency table. The Chi-square test of independence compares two different sets of frequency counts and finds out if they are independent of each other and the pattern of responses is different. In contrast, the Chi-square goodness of fit test compares a set of actual frequency data with an expected pattern of responses (Hinton et al., 2014).

A Chi-square test of independence using weight cases was performed to compare the formative assessment results of the traditional lecture and the flipped classroom groups. Weighting cases allows the assignment of importance or weight to the cases in the dataset (Yeager, 2017). Weight cases were used because the formative assessment was delivered using Turning Point technology, which gives aggregated anonymous results. To illustrate this further, the Turning Point output (the raw data) involves the percentage of correct answers and the number of responses for each question. From the raw data, the researcher was able to work out the number of correct and incorrect answers for each question.

3.7 The validity and reliability of the research

The principles of validity and reliability are pertinent to all research studies regardless of the methodological approach used. Threats to validity and reliability may arise at any phase of the research process, such as sampling procedures, instruments and measures, data collection, and data processing and analysis. Thus, applying critical thought to the research method and findings is essential in order to ensure that the quality and integrity of the data are realistic (Smith, 2010).

There is an agreement that the tests and measures used to determine the trustworthiness of findings in quantitative and qualitative research are different. However, the appropriateness of using the traditional quantitative criteria which are – internal validity, reliability and generalizability – to judge the rigor of qualitative research is still debated (Noble and Smith, 2015). Lincoln and Guba (1985) offer four criteria for assessing the trustworthiness within qualitative research, namely credibility, dependability, conformability and transferability. Other researchers argue that these are just an alternative terminology for the internal validity (credibility), reliability (dependability) and generalisability (transferability). Conformability is achieved in qualitative research when credibility, dependability and transferability have been tackled (Noble and Smith, 2015).

Internal validity is explained as “the extent to which the findings of a study are a true reflection of phenomena under study” (Smith, 2010, p. 57). Thus, the study findings must accurately represent the phenomena being investigated (Cohen et al., 2011). External validity (or generalisability), on the other hand, concerns the extent to which the finding of the study can be extended to a wider population (Cohen et al., 2011; Smith, 2010). Reliability is defined as “the extent to which procedures, measures, and data are reproducible or internally consistent” (Smith, 2010, p. 56). Validity and reliability related to different aspects of this research are discussed below.

3.7.1 The validity and reliability in qualitative research

As a step to ensure rigour and trustworthiness in qualitative research, addressing validity and reliability issues is essential (Sandelowski, 1993). Validity in qualitative research involves checking the accuracy of the study findings by employing certain procedures or techniques (Gibbs, 2007; Noble and Smith, 2015). Reliability, however, is concerned with ensuring that a particular qualitative approach is consistent across different research and projects (Creswell, 2014; Noble and Smith, 2015). The credibility of the qualitative research findings was ensured by undertaking a number of measures. Firstly, the principal researcher attended training workshops and read practical guides on conducting qualitative research and focus groups. Second, the focus groups were conducted and moderated by the principal researcher herself and this minimised the inconsistency that may have arisen if more than one researcher had been involved in the process. The focus group discussions were audio-recorded and transcribed verbatim to assist in data analysis. In order to ensure the accuracy of the transcripts, the project supervisors conducted accuracy checks on the transcripts against the original audio-recordings.

Qualitative data analysis was assisted by NVivo which enabled a comprehensive and systematic approach to data coding and interpretation. In addition, the analysis process was scrutinised by the project supervisors; this involved independently listening to the focus group interviews and reading the transcripts. Additionally, the project supervisors were actively involved with reviewing the coding of the raw data, the generated themes and the analytic narrative. This helped to minimise the researcher influence and bias that might have been introduced when analysing the data. The procedures followed in collecting and analysing the data are comprehensively explained; therefore, the reader is able to judge the quality of the research.

3.7.2 The validity in reliability in quantitative research

Concerning the quantitative research, the quasi-experimental design followed to conduct the study was the post-test only non-equivalent groups design.

Ultimately, this design lacks a pre-test and therefore it is not possible to determine whether any of the outcomes for the two groups are due to the intervention, or to other differences between the groups (Robson, 2011). It was not possible to deliver a pre-test since the teaching sessions are meant to be delivered covertly prior to data collection in order to prevent behavioural changes of the students. However, data validation and trustworthiness were guaranteed by methodological triangulation, which involves using more than one method of data collection (Cohen et al., 2011). Thus, validity in this quasi-experimental design which involved a survey administration and a formative test was strengthened by conducting focus groups (Robson, 2011). Another step that was taken in order to enhance the internal validity of this research was monitoring the intervention fidelity (discussed in section 3.3.1). Concerning the questionnaire, it was constructed based on two validated measures: the CUCEI and LSI (refer to section 6.2.2.1 for the validity and reliability of the CUCEI and LSI). Modifications made to the CUCEI may have affected the validity of this measure; however, responses to the questions contributed to understanding of the subject.

3.8 Chapter summary

The design of this research programme was informed by the literature review and the preliminary fieldwork that was conducted in the early stages of this research. The research was based on the pragmatic paradigm that involves using both constructivist and positivist worldviews. The design chosen to conduct this research is a quasi-experimental, embedded mixed methods design.

The research was conducted in two stages: stage one involved a qualitative study and stage two involved a quasi-experimental, mixed methods study. The quasi-experimental study adopted a post-test non-equivalent control and experimental group design. Due to the nature of this educational research, it was not possible to conduct a true experiment because of the unfeasibility of randomly assigning the students to the study groups. Focus groups were chosen as the most appropriate qualitative approach to meet the aims and

objectives of the qualitative phases. Due to the timeframe of this research and in order to achieve an in-depth discussion, the individual interviews approach was rejected.

The qualitative approach was adopted to enable the impact of the flipped classroom method on students' satisfaction and knowledge acquisition to be examined. The qualitative approach will allow an in-depth exploration of students' views on different teaching and learning methods.

This research took place in two pharmacy schools in the UK: UCL School of Pharmacy and the School of Pharmacy and Biomedical Sciences at University of Portsmouth. A purposive sampling approach was adopted in this research since participants needed to be deliberately selected in order to fulfil certain conditions.

Agreement to participate was granted from collaborating departments at both pharmacy institutions and this research has been approved by UCL research ethics committee.

This chapter also presented the data processing and analysis in quantitative and qualitative research, the validity and reliability of the research.

Chapter 4 Stage I Method

In this chapter, the methods employed to meet the aims and objectives of the first phase of this research are described. This chapter begins by reporting the study aims and objectives. It then goes on to the development of the topic guide schedule, the sampling strategy and procedures, and the conduct of focus groups. .

4.1 Aims and Objectives

4.1.1 Aims

This study aimed to explore the teaching and learning experiences of final year MPharm students. It further aimed to determine students' views about the flipped classroom teaching method prior to a teaching session using this approach.

4.1.2 Objectives

1. Determine students' perception of the traditional lecture and other methods of teaching and learning the students have already experienced.
2. Determine students' expectations and attitude towards the flipped classroom teaching method prior to experience.

4.2 Methods

A qualitative approach was chosen to meet the aims and objectives presented above. The rationale for choosing a qualitative approach is presented in section 3.3 of the methodology chapter. The study was carried out during the academic year 2014/2015 (refer to section 3.4.1 for the study setting).

4.2.1 The development of the topic guide schedule

To achieve the objectives of this study, a topic guide schedule for the focus groups was developed (Appendix 5). The literature review and the

preliminary fieldwork informed the questions that were included in this topic guide schedule. The topic guide was designed to stimulate participants to talk in detail about their perception of different teaching and learning methods. The first two questions examined participants' viewpoints regarding the traditional lecture. The third question addressed students' experience of the other methods of teaching they came across in the MPharm curriculum. The fourth question investigated how differently science-based subjects and pharmacy practice subjects are taught in the MPharm programme. Another question explored the technologies that are used to aid in teaching and students' views about them. The last four questions of the topic guide were designed to investigate MPharm students' views on the flipped classroom teaching method, and their expectations concerning the impact of this teaching method on their learning, assessment and being a pharmacist.

The topic guide was initially reviewed by the research team and amendments were suggested and applied. A pilot test was conducted in the form of individual interviews with two MPharm students at UCL School of Pharmacy. Each student was asked to listen to the questions, give their answer, and finally provide their opinion on the questions and suggest amendments to improve the topic guide. This pilot testing helped to identify if the questions were easy to ask aloud and if the words flowed smoothly. Additionally, it helped establish the clarity of the questions (Krueger and Casey, 2015). In the question 'If any, what are the differences in teaching approaches between science-based subjects and practice-based subjects?', pilot respondents advised the researcher to replace "practice-based subjects" with "pharmacy practice subjects", and to give an example of each subject.

4.2.2 Sampling

4.2.2.1 Sampling strategy

Students enrolled in year four of the MPharm programme academic year 2014/2015 were purposively selected for this stage of the research. The reason for choosing the final year of the MPharm is based on the assumption that this group of students has experienced more teaching and learning

methods than earlier year groups. A justification for the sampling strategy is presented in section 3.4.2.

4.2.2.2 Sampling procedure and recruitment of focus group participants

The strategy that was followed to select and recruit the focus group participants in this study is known as *'piggyback selection'* (Krueger and Casey, 2015). Piggyback focus groups are added to an already scheduled meeting with the people who meet the eligibility criteria of the study (Krueger and Casey, 2015; Smith, 2010). This method often involves communication with only one group member who facilitates the seeking of views and agreement from others (Smith, 2010).

This approach was used following unsuccessful attempts to identify participants, obtain their agreement to take part in the focus group, and finally agree on a time and date convenient for everyone. A total of eight students agreed to take part in the focus group at UOP, and seven students were recruited at UCL SOP. The focus group at UOP was scheduled on the 9th January 2015, 10:00-11:00, just before an academic meeting. UCL SOP's focus group was arranged on 27th February 2015, 17:00-18:00, just before a social gathering for the participants. All recruited participants were sent a confirmation email for the focus group indicating the time and location. Additionally, they were sent an electronic copy of the participant information sheet and consent form (Appendix 6, Appendix 7).

4.2.2.3 Conduct of focus groups

Only one focus group was conducted in each pharmacy institution. At UOP, six out of eight students turned up for the session. Five out of seven students attended the focus group discussion at UCL SOP. The focus groups were conducted by the principal researcher and were held in the main building of each pharmacy school. Before commencing the focus group, the researcher went through the information sheet with the participants and they were given the chance to ask any questions regarding taking part in the focus group. The participants were reminded that there were no right or wrong answers

and were encouraged to share their opinion, even if it was different from what others said. The researcher explained to them that the discussion would be audio-recorded to ensure accuracy in collecting the data. Additionally, they were reassured that their names would not be included in any reports, and their confidentiality would be maintained. The participants were reminded that participation was voluntary, and their opinion, a decision to withdraw at any time, or a decision not to take part would not affect them in any way. Finally, the participants were asked to sign a written consent to take part in the focus group discussion. All participants agreed to the audio-recording of the discussion and to take part in the study.

The researcher facilitated the focus group discussions with the aid of the topic guide schedule. The participants were allowed to express their views freely and the researcher avoided interrupting respondents. In order to make sure that each question was explored fully, the researcher used two simple techniques to request further information. The first technique was using a five-second pause coupled with eye contact after a participant comment. This strategy encouraged the participants to add further viewpoints or simply agree with what had been said. The other useful technique that was employed was requesting more information by using probes such as *'Can you tell us more?', 'Can you give us an example?'* and *'Is there anything else you would like to add?'* (Krueger and Casey, 2015).

In an attempt to encourage participation from all the focus group members, the researcher asked prompting questions during the discussion such as *'Does anyone else share this view?'* and *'Does anyone else have a different view?'* (Smith, 2010).

The first focus group was conducted at UOP, and the researcher sought the participants' feedback regarding the clarity of the questions or the focus group procedure. The participants acknowledged that they had no concerns to point out regarding the questions or the conduct of the focus group. Each focus group lasted between 50 and 60 minutes.

Chapter 5 Stage I Results and Discussion

This qualitative results chapter reports on 11 participants in total (*n=5* from UCL and *n=6* from UOP). To ensure anonymity, all participants have been given pseudonyms (see Table 5.1 below). The main findings suggest that there are several factors that influence the learning experience of students. From the thematic analysis, the following overarching themes were revealed: *'Teacher characteristics'*; *'Having the right tools to learn'*; *'To prepare or not to prepare?'*; *'Scaffold the delivery of teaching'*; *'Learning can be emotional'*; *'Group work: what's in it for me?'.* A thematic map depicting each main theme and its associated sub-themes is given in Figure 5.1.

Table 5.1: Focus Groups' Sample Demographics

Pseudonym (P*)	Gender	Institution	Age
Ashley (P1)	Female	UCL School of Pharmacy	22 years
Fatima (P2)	Female	UCL School of Pharmacy	21 years
Gemma (P3)	Female	School of Pharmacy and Biomedical Sciences, University of Portsmouth	21 years
Lina (P4)	Female	School of Pharmacy and Biomedical Sciences, University of Portsmouth	22 years
Marion (P5)	Female	UCL School of Pharmacy	21 years
Martina (P6)	Female	School of Pharmacy and Biomedical Sciences, University of Portsmouth	23 years
Nadia (P7)	Female	School of Pharmacy and Biomedical Sciences, University of Portsmouth	22 years
Sandy (P8)	Female	UCL School of Pharmacy	22 years
Sara (P9)	Female	School of Pharmacy and Biomedical Sciences, University of Portsmouth	22 years
Sean (P10)	Male	School of Pharmacy and Biomedical Sciences, University of Portsmouth	21 years
Tiffany (P11)	Female	UCL School of Pharmacy	23 years

* Participant number

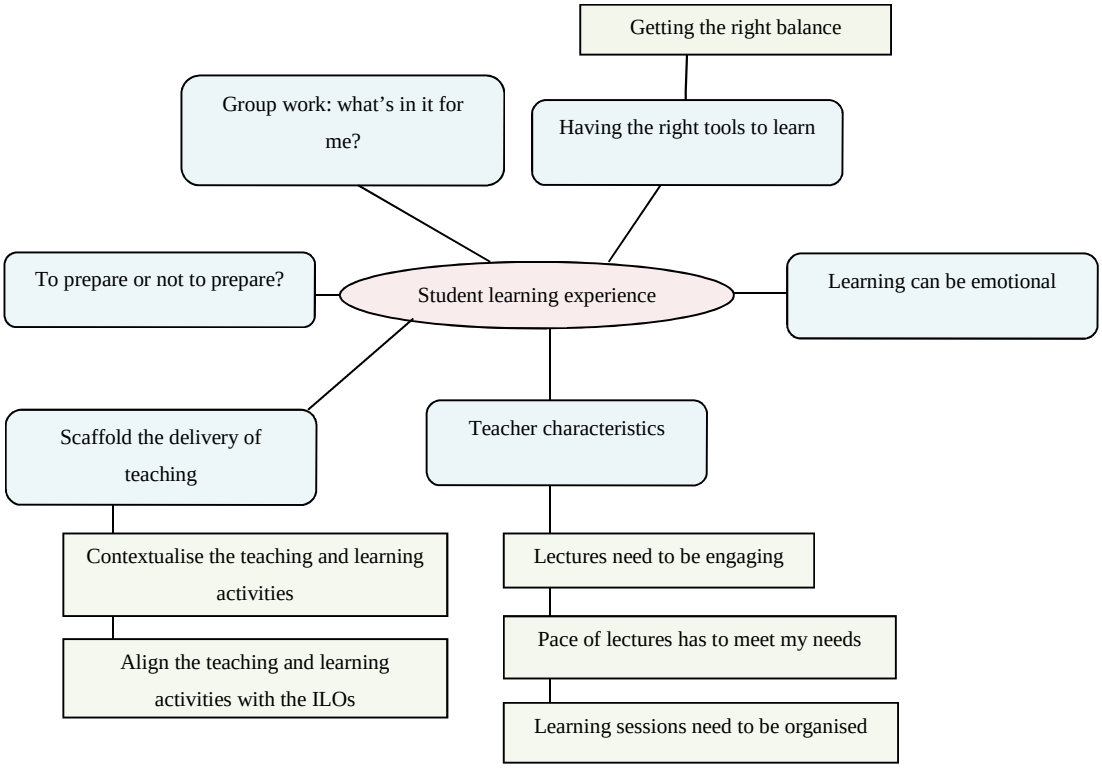

Figure 5.1: Thematic Map: MPharm Student Learning Experience Study

5.1 Teacher characteristics

Characteristics and qualities of the educator were identified as major factors that have an impact on the learning experience of students. Such characteristics seemed to influence students' learning both positively and negatively, irrespective of the subject area or the teaching approach being used. Participants referenced both negative and positive teacher characteristics they came across in their MPharm programme. The positive qualities included approachability, helpfulness and creativity. These positive qualities could create a positive learning environment by, e.g. encouraging a good student-teacher relationship, encouraging students and helping them to overcome their fear and shyness in the classroom, and also introducing some elements of creativity into the classroom.

> *"Most of them will say come and knock on my door, come and say hello it will be really open door policy, so I think most of us have*

quite a good relationship with the lecturers as well [LAUGHS]" [P3,UOP]

"Sometimes I think it might even be difficult for the lecturers when they are asking us questions [LAUGHS] and we are not always providing any sort of feedback because maybe we're too scared to answer their questions and in case its wrong or I don't know, but then there are some lecturers who like actually, like you know, they like ENCOURAGE, they encourage not intimidate you, they encourage us to participate and give our opinion and ask questions and then I like that" [P1, UCL]

"I think I like it [the group work] when they make it creative, not like by presenting but by like more fun to learning instead of just memorising" [P5, UCL]

The negative characteristics were poor communication skills, low motivation, lack of confidence, intimidating and not providing enough guidance. These in turn could negatively impact the students' learning experience, leading to annoyance, disengagement and boredom.

"It depends like if the lecturer, the tone of voice as well, sometimes it tends to be very monotone, it is very hard to keep up and stay awake". [P2, UCL]

"It is really dependent on the mood the lecturer's in as well. If no one, hardly anyone is turning up, then they'll be like what's the point. It's sort of negative feedback then if they're not bothered, we're not bothered and then there's less people next time. It ends up being just me sat there going… erm… [LAUGHS]" [P10, UOP]

"The difficulties the main one is when you have a lecturer who is not good at what they do, [the subject is good], so .. the subject is good .." [P6, UOP]

"Unfortunately I think it [identifying students who didn't do the pre-work] involves, installing fear that you are going to get caught out for us to do it, its terrible thing to say, yeah, as we've grown up I think you have kind of seen the benefits of doing it anyway [LAUGHS]" [P7, UOP]

"There was not normally enough guidance [in labs], they [the teachers] expect too much. I do enjoy them [labs] but I just think some of the teachers don't explain it well enough and they are sort

of why you don't know! I don't know, that's why I am here!!" [P10, UOP]

5.1.1 Lectures need to be engaging

This sub-theme explores a negative aspect that is a common feature seen in most traditional lectures. The lack of student engagement during traditional lectures could trigger student boredom and result in them being inattentive or distracted. Creating a dynamic lecture and engaging students with the lesson lies mostly in the teacher's hands. Thus, strategies could be adopted to make the lectures more engaging to captivate students' attention. For instance, TurningPoint could be used in a large lecture to engage students. Frequently, the minimal or lack of interactivity in the lectures was attributed to time constrains associated with delivering the content of the curriculum.

"But some people are practical learners, so it's quite difficult to sit there [in a lecture] and listen" [P9, UOP]

"You do feel for the lecturers sometimes, because they have their lecture hours cut and cut and cut every year so they are trying to fit ten hours material into seven and five then you think how the hell they are gonna do interactive where they want the whole year to participate in conversation about something when like you said, and they got to get so much in fifty minutes they can't afford to take five minutes out of that lecture, or ten minutes out of that lecture to have something interactive going on the syllabus and the GPhC still stipulate that this has to be covered, so it has to be covered" [P3, UOP]

"Difficulties staying awake sometimes [LAUGHS] if it is too long and not interactive" [P5, UCL]

"When they ask questions, it's nice when they ask us questions or let us be more interactive instead of just one hour .. [talking to us instead of just listening],yeah" [P2, UCL]

"Sometimes you can't always sit there for 50 minutes and listen to someone. It's like your attention span can go up and down, and you zone out like what she said you zone out and you don't even get what they are saying. Sometimes you can go back in, zone back in and get back on same bit sometimes once you zoned out you can't, you can't really go back that's it" [P1, UCL]

> *"Even 50 minutes is quite hard work. Sometimes, first 10, 15 you normally engaged then you feel yourself switching off"* [P3, UOP]

When discussing the benefits of the flipped classroom teaching approach for students' learning, the participants referred to the challenges of the traditional lecture, and they pointed out that the flipped method could foster class engagement. The pre-class learning gives students a foundation knowledge, which in turn gives them an indication of what to expect during the contact time. Thus, this fosters student confidence and attention, and encourages active engagement with the lesson.

> *"Remember the information and understand what you are learning before going into the lecture so you know what to expect, and you will be more interactive in the session because you know what they are taking about [LAUGHS]"* [P2, UCL]

> *"I think it would make you more active as well, like you would want to learn more about it"* [P5, UCL]

> *"I think you will be more confident as well with what you're saying instead of trying to hide which I do [LAUGHS]"* [P11, UCL]

> *"I think it is a good idea, because when you do the pre-work and then attend a lecture, you feel so much better because you know what they are taking about"* [P4, UOP]

> *"I think also if you have looked at it before you come to lecture you sort of engage more into what's going on in the lecture as well"* [P9, UOP]

5.1.2 Pace of lectures has to meet my needs

This sub-theme captures the lack of fit between the pace of the traditional lecture and students' needs. Good lecturers are the ones who are able and make an effort to pace the lecture appropriately, considering the subject's difficulty and students' needs. Typical classrooms have students with diverse abilities and the pace of the lecture might not be right for every student. Traditional lectures are normally delivered in a large classroom setting; thus, pacing the instructions in a way that meets all students' needs is challenging.

> *"I know there is a few of us in our year that have the actual time dyslexia kind of things, so we process things differently and sometimes slower as well and then it just takes you a little bit longer to kind of process and personally I hear the first bit of the sentence and maybe write it down and the second half is gone, and that's normally the important bit [LAUGHS]"* [P3, UOP]

> *"I have already gone through that, I am not going through it again [you haven't gone through it well enough"* [P7, UOP]

Stemming from the fact that the pace of the traditional lecture is not appropriate for all students, especially when it is used for delivering a new or difficult concept, the participants felt that the flipped classroom might be a suitable alternative.

> *"Sometimes the topic is so confusing when you go to the lecture, the lecturer just completely loses you because they are going to something else and you are just on page one do you know what I mean and so I think in terms of really confusing topics I think that would be a good idea"* [P8, UCL]

> *"It [the flipped classroom] is definitely useful for really difficult subjects or new subjects that we've never done, biology, chemistry we have done at GCSE, whereas clinical subjects introduced in third year or second that's it, so its brand new"* [P7, UOP]

5.1.3 Learning sessions need to be well organised

This sub-theme captures the importance of carefully planning learning sessions in order to create a high-quality learning environment. A good educator is accountable for employing organisational measures in order to run effective teaching sessions. For instance, these could include lesson or activity planning and use of time. The focus group participants expressed concerns over organisational aspects of some of the active learning sessions. In terms of the publicity of the pre-work, the students acknowledged a need for improvements. One suggestion is uploading the pre-work for students on Moodle in advance, followed by subsequent reminders. Additionally, the participants were apprehensive about how the

session time is used, and they thought that some sessions are very long in relation to the class activities.

> *"They [case studies] were really unorganised, wasn't it? from the lecturer's point of view because one particular lecturer was supposed to be taking the lead and didn't, I think it is a very good set up it just needs tweaking and ironing out. [definitely, to optimise]"* [P3, UOP]

> *"I do [like workshops] .. erm some! Well, like what they said if it [the prework] is relevant and where is active, but some of the pre-work like we see out of the blue [LAUGHS] I think if they send it in advance may be I will do it"* [P5, UCL]

> *"There was stuff up on Moodle like dribs and drabs and you just like I really want the whole picture from the start [LAUGHS] is that what you mean"* [P8, UCL]

> *"I think last year or the year before they would give erm just a quiz on Moodle as pre-work and post-work and I would do it and it would like help my learning which I did in class, whereas these ones I just don't know how to .. I find it random. It's not on Moodle, nothing on Moodle [Marion: we knew beforehand that we gonna have pre-work and post-work], and it wasn't marked, but even though it wasn't marked I would still do it if I find it relevant"* [P11, UCL]

> *"[Workshops are] time consuming, there are two hours, two hours sometimes a bit too long, sometimes that we are just sitting around for like half an hour waiting for the next bit. [Sean: the first half an hour is not used really well]"* [P9, UOP]

5.2 Having the right tools to learn

'Having the right tools to learn' was a prevalent theme in the focus group data. It captures the necessity of equipping students with what they need for learning that complements each particular teaching method. An effective teacher must provide the learners with relevant learning resources in a timely manner. This could be regarded to some extent as a shared responsibility between the educator and the institution. For instance, the institution should provide the necessary facilities, equipment and time to aid in creating or providing the right learning tools that facilitate the learning process. Providing

access to recorded lectures, for example, is not feasible without offering the recording equipment and technological support. With respect to the traditional lecture, the focus group participants acknowledged the need to provide access to lecture slides during the lecture to aid students with note taking. Having access to recorded lectures was seen as positive as it could assist those students who find the pace of the lecture is too quick for them to absorb the information. In addition, students stressed that there is a need to offer comprehensible learning resources to help students learn the lecture afterwards. Regarding learning activities that require preparation, the participants highlighted that there must be a match between the learning material assigned and the planned activity. In other words, the learning resources must be relevant to the active session. In addition, providing access to internet-ready devices such as iPads during active learning sessions was perceived as positive. Thus, students can benefit from accessing a wide range of web-based resources.

> *"One of the lecturers I think one year, she gave slides and then she gave us supplementary notes and that's quite nice because the slides are quite brief and you make your own notes, but sometimes they are really quick for you to write everything down, so yeah you have to record it or its quite nice when they give you extra notes I think it is really helpful"* [P1, UCL]

> *"I find it better when the lecturers have the PowerPoint on Moodle so or on like BlackBoard so that we can download them and have them in front of us .. to annotate, [to look around it], I find it difficult when they don't have that up and they kind of scribbling down lots"* [P7, UOP]

> *"I like it if they give you the resource you suppose to use to find information"* [P7, UOP]

> *"We got like recordings which I don't know if that counts under this [technology] but help us when you wanna go over things again so I really think that really helps when lecturers record their lectures"* [P1, UCL]

> *"The formulation one [resources] are very good this year as well they are very easy to understand, so you can see the lecturer has*

gone through, I don't know, lots of articles, and picked the ones that are easy for us to understand" [P6, UOP]

"Sometimes they don't give relevant ones [pre-work] like for greenlight ones they gave an article that wasn't relevant to be honest" [P11, UCL]

"They do use iPads sometimes in workshops, so sometimes they bring in iPads so when you are trying to figure out BMI and the cardiovascular 10 year risk we had iPads, it was helpful like if you want to do, find out something you don't know and you don't have the resource there, you can get an iPad and do a research the information, so we have that resource available" [P2, UCL]

When discussing the potential challenges of the flipped classroom teaching method, the participants stressed that the pre-session learning has to be directly related to what is to be discussed in the class. Thus, the pre-flipped learning should be relevant to and integrated into the active flipped session.

"I think the pre-work has to do .. I suppose it's easy to get the information, so say if there were questions there would have to be kind of directly linked to what I was listening to in the lecture not really obscured to finding it or wishy-washy" [P11, UCL]

"I think that would work if when we come to the class we actually use them because sometimes we do the work and we come to lecture and it is not, you know, it's not related" [P6, UOP]

Additionally, the focus group data suggested that the pre-flipped classroom learning materials should be provided in different formats, thus accommodating student diversity and different learning styles. For instance, some students prefer listening to a recorded lecture when preparing for active sessions while others prefer reading. Therefore, providing flexibility in the learning resources could assist students to complete their independent learning.

"I think articles are better than videos because you can do it anywhere rather than a video" [P6, UOP]

"I do appreciate a video I think .. I think I find it more engaging than reading a piece of paper and answering questions, I don't tend to do those to be honest" [P7, UOP]

"I don't want one or the other, both is … [both, yeah], having the option then" [P3, UOP]

5.2.1 Getting the right balance

'Getting the right balance' is a sub-theme that captures the need to sensibly balance the learning tools in terms of quantity and the relevance to the topic being covered. The participants highlighted some negative aspects related to learning material such as not having enough content in lecture notes, and overloading students with a big reading list.

"Some lecturers they just literally have nothing on the slides apart from like pictures. There is one like fifty slides on asthma pumps, then when I was going back to it, what I was suppose to do? So I think it is important to have content on it, well not too much because you can get bored of it" [P5, UCL]

"Lectures have a reading list at the end, but sometimes they have such a big reading list that you don't know which one .. you not gonna read over all of them. If they give us the relevant ones [or the relevant chapters instead of saying the whole book, LAUGHS]" [P2, UCL]

5.3 To prepare or not to prepare?

When discussing the benefits of the traditional lecture teaching approach and participants' views on the flipped classroom teaching method, the theme *'to prepare or not to prepare'* was identified. This theme illustrates the difference between the two teaching methods with respect to approaching the learning through the scheduled contact time. The data showed that there is an ease associated with the traditional lecture approach as students are expected to show up to the class and listen to a lecturer. In this teaching approach, the lecturer is responsible for both preparation of and transmitting the information to the audience. Students can also benefit from peer support and having face-to-face contact with a lecturer.

"I think it enables the lecturer to get all the information across, whereas sometimes they might not be able to in different more interactive settings" [P2, UCL]

> *"You get to a point that ok I think today I am not gonna bother, no one is going to pick on me and sit back"* [P9, UOP]

> *"Another benefit is that the lecturer is there so you can ask them at the end of the lecture if you have missed something, so it's good to have that contact"* [P4, UOP]

> *"The benefits though that you get to a communal area where like where all your peers are, or your friends and you get to kind of listen and ask 'What did they say?' 'Can you tell me?' Yeah, that's the good thing [LAUGHS]"* [P7, UOP]

On the other hand, students are expected to take responsibility for their learning in a flipped classroom approach. In other words, student preparation by completing a pre-flipped session independent learning is fundamental for student engagement with the in-class learning. This judgment has been based on previous experience of different teaching methods that have similar requirements to the flipped classroom.

> *"Sometimes if you didn't do the pre-work and you go in and you don't gain as much because you didn't do the pre-work, so like if it is different style of lecture like spoon-feeding, like you'd gain as much as everyone else, yeah"* [P8, UCL]

> *"Especially for formulations we had quite a lot of pre-activity work with the calculations and then we came up, and then we came in a lab and we had to make our formulation and if you hadn't done the pre-work, you don't have numbers to work with any way so you [LAUGHS], so it was quite important to do the pre-workshop"* [P4, UOP]

The focus group data suggested that helping students to take control of their own learning through the independent learning required for the flipped classroom is expected to develop professional attributes essential for the pharmacist career. The participants thought that the flipped classroom teaching method might create autonomous learners, introduce good working ethic and promote professionalism.

> *"I think because you would be into the habit possibly of like erm you know going over things before the actual session you might actually be like that when you are working as a pharmacist and*

then you go into these training days or whatever you wanna call it courses and even when you are doing your own learning, it would be like ok I've done this before and I have like gone through it myself before, so I think in the long run, yeah it might be useful" [P1, UCL]

"It helps your CPD as well because if you are doing something in the shop or in the hospital or whatever and you say 'All right, OK I don't know that', you know what sort of thing to look at, how to approach it how would you approach it because you have done it in your own time" [P10, UOP]

"Introduces good work ethics" [P8, UCL]

"I think it's [the flipped classroom] good for pharmacy students because we can't just do, we can't just do it for exam, forget about it, we actually have to implement it in our careers so .. for you to get through it needs cement and bricks for our profession I think" [P7, UOP]

Preparation for the flipped active session, however, requires motivation, which could be difficult to specify in light of the diversity of students in a single classroom. Students seem to perceive a task as worth doing in response to motivational factors that range from extrinsic to intrinsic. Adding an incentive in order to encourage students to complete the pre-flipped session learning is an example of extrinsic motivation, while completing the task because of understanding its long-term rewards is linked to intrinsic motivation.

"But then you need some rewards and some incentives for that I think, instead of having exams towards the end of the year, you could have things which add up throughout the year, either if they are small percentages or five, ten percent worth" [P3, UOP]

"I don't think I need incentive, if it was going to take the burden of me towards the end of the year, I think I'll do it, and also if you gonna be asked in the lecture a question, you going to want to know the answer. You don't wanna look stupid so I think that is an incentive enough for me, I don't think I need an examination" [P7, UOP]

High workload is another factor that could be a barrier to pre-flipped active session preparation. The increase in the workload associated with the

preparation in the presence of other concomitant coursework was found a challenge that might promote disengagement with the learning.

> *"To be honest, if we had to do it now I don't think to be realistic it's a good idea, it wouldn't work because we have a lot of things to do, we have a project, we have a frameworks, erm we probably just can't do it, I can't fit it in"* [P6, UOP]

> *"Sometimes it gets a bit difficult to do if you have other assignments to do, because you get post-work after the lecture as well"* [P2, UCL]

5.4 Scaffold the delivery of teaching

This theme was identified when discussing students' views on the expected impact of the flipped classroom teaching method on their learning, assessment and being a pharmacist. It captures how learning through a flipped classroom environment could potentially overcome the pitfalls of the traditional lecture approach. Typically, students are not required to make any effort in learning before or when attending the lecture. Consequently, rather than being in the habit of revising and studying throughout the year, as in the flipped method, students experiencing the traditional method normally only go over lecture materials for the first time when revising for examinations. Due to the high workload students face during the exam revision period, they are likely to adopt a surface approach to learning, which involves rote learning instead of understanding.

> *"With the traditional method you like introduced to it and you have to go over do your work, make your own notes, then revise and then revise again"* [P1, UCL]

> *"Prioritising our tasks. I think we do get away with being really lazy in the course [Ashley: yeah and we leave it till the last minute, LAUGHS]"* [P11, UCL]

> *"Students can be lazy up to a point, I guess, apart from the stereotype"* [P3, UOP]

"I think, I think rather than remembering everything in a really concentrated period of time towards exams its encouraging those people to actually start to learn it throughout the year" [P7, UOP]

"I still like it because I feel like I'm doing something before I go to the lecture, because usually I am having to rely on going to the lecture and then finally doing the work after the lecture, and I find that harder because I usually end up doing it towards revision period which is not a good idea" [P1, UCL]

However, the flipped classroom teaching approach adopts a particular order in which learning occurs in two successive stages and develops from lower- to higher-order thinking. Knowledge acquisition occurs outside the classroom, and a deep approach to learning takes place during the contact time through engagement with active discussions guided by a lecturer. This in turn is expected to better manage students' studying, and greatly reduce their exam revision workload. In addition, the contact time is expected to allow students to identify gaps in their knowledge, benefit from asking questions and also learn from their peers. Therefore, deep understanding of the materials taught and learning consolidation could improve students' grades.

"Less cramming and takes the edge off" [P4, UOP]

"I think it would help to consolidate it like you are learning twice type of thing so I think in terms of revision because you already learned it twice and it might even improve my grades" [P8, UCL]

"I think it would help us to remember everything that we did" [P6, UOP]

"It's more like that you, because when you cram it's more like memorising things and trying to write the stuff down, but if you have something like this [the flipped classroom], we understand ourselves so we are not really memorising or writing stuff down, it is sort of from your understanding" [P9, UOP]

"More confidant, I mean more depth I think, it's quite often you just skim the top, you just take the top of the surface, and you don't go into more depth" [P3, UOP]

"As we were saying before you have all the information, so if you don't know the information then you can ask and then if you discuss it, erm other people might have questions that you didn't think of, so you will have the information as well, so you would have the benefit of everyone's knowledge as well" [P2, UCL]

5.4.1 Contextualise the teaching and learning activities

This sub-theme describes the necessity of making the learning in active classrooms relevant to students' anticipated workplace experience. It was evident in the focus groups that students were in favour of active learning sessions that are close to practice and that involve some elements of simulation.

"[The good thing about the case-based learning] It was very much linked to practice, and one of the lecturer, two of them are very much keen on making it very much realistic to community base so it was what you come across in community but harder versions more complicated conditions and diseases that you may come across but that was good" [P3, UOP]

"I think also some people have gone to their degree without necessarily getting much work experience and no idea what it involves, so it was really good for, the simulation is a very good place to start before you actually meet a real-life person" [P7, UOP]

"Because we are fourth year now and obviously we gonna be in practice next year, I like the ones that they really take the subject and turn it into something that we can visualise during next year and make it all patient focussed. I wish they did that more throughout" [P8, UCL]

"In the workshops they also used in asthma one, we got to actually use erm like proper machines that fake asthma pumps the one .. what's that one that could actually .. when you doing .. I think its metered dose inhaler that actually showed if it went down into the lungs or not. Whether you doing it properly" [P2, UCL]

"Because it is either that or you just reading from a piece of paper and you just like using your hands to do actions but you don't really know, sometimes you might not even know what the actual device looks like, and how to even open it up. It is just getting you a feel of it" [P1, UCL]

5.4.2 Align the teaching and learning activities with the intended learning outcomes

This sub-theme captures the importance of carefully aligning the teaching and learning activities with the intended learning outcomes. It was evident in the focus groups that the teaching methods used for science-based subjects and pharmacy practice subjects were different. Participants thought that the content of the pharmacy practice units was not difficult to understand independently and they viewed the traditional lecture used to deliver such topics as unnecessary. However, gaining the skills required to implement the knowledge is a key. On the other hand, science-based subjects are mainly fact-based with complex concepts that need to be explicitly explained to students by direct lecturing.

> *"With pharmacy practice side of things, I think lectures that are being delivered are not really necessary as such because the content is not difficult to understand, you just need to implement it [Gemma: the skills involved, isn't it?], whereas the pharmacology side of things and chemistry, its .. you need to listen to somebody explain it because it needs to be understood before you can memorise it"* [P7, UOP]

> *"The practice is more like learning skills rather than just knowledge"* [P10, UOP]

In addition to the lecture, active learning methods are used to deliver pharmacy practice subjects, e.g. workshops. These teaching approaches enable students to develop transferable skills specific to the role of pharmacist. In contrast, labs, seminars, simulations and computer-aided packages are the main approaches the participants have experienced to consolidate their learning of the science-based units.

> *"We have like labs, lectures, for the chemistry and pharmacology side of it, and we got more hands on workshops, approachable side of things in like practice"* [P3, UOP]

> *"For pharmacy practice I thought like it has to be different like we had like smaller classes doing like activities like dispensing and labelling and all that, and then I think a lot of it to deal with roles*

and regulations as well in pharmacy practice. Yeah, so they have to have different teaching styles" [P8, UCL]

"It could all be different presentations [in practice], a patient can be coming with a cold everybody could be slightly different, so in that case you get to learn a generic approach to dealing with that and then just adapt what you told" [P3, UOP]

"We had computer-aided packages as well like Calb. It was just to help us with chemistry and there was another computer aiding package for formulations as well that helped with rheology linked with the formulations" [P4, UOP]

"Going back to first year, I was thinking there was three methods for pharmacology, we had lectures that is to deal with the basis, we had seminars to sort of consolidate where he would quiz us and stuff, and then we had our labs as well because we had the rabbit ileum, it was quite good to see like how the whole thing even means" [P8, UCL]

The focus group participants felt concerned about the appropriateness of some topics to an active learning format. Thus, educators should carefully align the learning outcomes of the course with an appropriate method for delivery.

"Sometimes you think is it really appropriate to that format, so is it really appropriate to having it in a workshop, [They sort of shoehorn things in]" [P3, UOP]

5.5 Learning can be emotional

The focus group data suggested that different learning environments could trigger students' emotions, both positively and negatively. Anxiety is one of the negative emotions that is frequently experienced in unfamiliar learning environments, or those that make students feel scrutinised. Asking or answering questions in large groups such as in a lecture have been seen as threatening, and students would avoid being in these situations. Reluctance to engage in lectures, which normally involve hundreds of students, is attributed to shyness or fear of embarrassment in front of a large crowd.

"I think it [AVATAR] was good for the first year because when we started doing our workshops and having patients [it was nerve-racking] I was a bit less nervous because I was working at that time but I can tell we were all really nervous to see somebody as the patient" [P6, UOP]

"Looking back we will say yeah we really enjoyed it [the simulation workshop] but at that time you know 'oh GOD, they are recording us, they are like watching us', oh such a stressful situation" [P3, UOP]

"Those who don't have the confidence to speak up in class, I don't, I hate asking questions, in fear that it's a stupid question or I would get an answer wrong" [P7, UOP]

"I think maybe one of the disadvantages that you been more shy to ask a question in like .. in front of everybody" [P8, UCL]

"It is easier when we have smaller groups, in a huge lecture hall it's too hard, it's too intimidating [LAUGHS]. When we have a smaller classroom say 30, 20 it is easier to be interactive, easier to talk" [P2, UCL]

"*Yeah like once, there was an answer and I knew it, and the answer was four words, but I would never say that in like in front of everyone"* [P8, UCL]

"I like it [turning point] because I am quite shy and I don't put my hand up or anything so it's giving anonymous answers" [P11, UCL]

"Sometimes I think it might even be difficult for the lecturers when they are asking us questions [LAUGHS] and we are not always providing any sort of feedback because may be we're too scared to answer their questions and in case its wrong" [P1, UCL]

"One thing is you can't really ask questions so much, when as our years developed together, we are not so bad at shouting out in front of each other if we really don't get something, but at the same time you can be sat there like going I don't really get what is this about, you will never really gonna clarify it too much" [P3, UOP]

Exposing students to a new or a challenging learning environment could trigger negative emotions such as frustration, anger and anxiety. Resistance to the change in the learning environment is likely to be temporary as

students usually learn strategies to deal with mastering the new environment and overcome their negative emotions. Based on the students' experience, introducing the flipped classroom into the MPharm programme is likely to be faced with resistance initially. Thus, in order to give students a chance to adjust to the unique requirements of the flipped classroom, this method should be introduced in the early years of the MPharm programme.

> *"To began with, it was like' What the hell?' we don't get this [seminars], because we got a booklet and it was ' Do it, get on with it and we will discuss it', actually that worked really well"* [P3, UOP]

> *"I am glad they did it [first year simulation workshops] because it sorts of forces you to push yourself"* [P10, UOP]

> *"That's what I mean by installing it [the flipped classroom] in first year so you get the silence in first year, and people start to get the hang of things and more comfortable with answering questions [Gemma: it sounds like a fear thing, some people don't say anything]"* [P7, UOP]

> *"Also I feel it have to be installed in first year so that you know, you expected throughout, if it is installed just in fourth year I don't think, it would be hard for us to adapt"* [P7, UOP]

> *"It would be hard for lecturers to get us to that state of mind"* [P9, UOP]

> *"To be honest, if we had to do it now I don't think to be realistic it's a good idea, it wouldn't work because we have a lot of things to do, we have a project, we have a frameworks, erm we probably just can't do it, I can't fit it in"* [P6, UOP]

Small classes, however, have been perceived as an emotionally safe environment where shyness and fear of being humiliated are not common features. Active learning classes such as workshops are normally run in a small classroom setting where it facilitates students' engagement with the learning.

> *"It is easier when we have smaller groups, in a huge lecture hall it's too hard, it's too intimidating [LAUGHS]. When we have a*

smaller classroom say 30, 20 it is easier to be interactive, easier to talk" [P2, UCL]

"It [workshops] is more of a relaxed atmosphere where people feel confident enough to ask questions [yes, I ask more questions in workshops], I think it's probably because there is less people and if you get it wrong, only five people hear, rather than a hundred [LAUGHS]" [P7, UOP]

"It's also quite nice it is a very similar set up to this in that you will all jump in with something, oh yeah hold on for a minute what do you mean by that" [P3, UOP]

5.6 Group work: what is in it for me?

This theme captures students' attitudes towards group work. Commonly, working in groups is seen as unfavourable task when students fail to see rewards or benefits from it. It was apparent in the focus groups that there is a great distinction between assessed and non-assessed group work in terms of students' satisfaction. The students reported that random group allocation for the assessed group work forces them to work with students with diverse levels of ability, effort and input. They felt this was unfair as the group members have different goals and therefore they expend different amounts of effort, but they are awarded the same grade.

"This year especially some of the elements of the units are tested using coursework but it's group work and this year especially we've all been up in arms about one particular piece and they all think this is due to the group work he doesn't have any opinion on that it's the content or anything like that, this is purely because the group work and they hate group work" [P3, UOP]

"This may sound really pompous, so I apologise, but sometimes if you are being pushed .. mashed up into a group without any choice you are kind of dragging along people that aren't as good as you or lazier than you or don't try as hard and don't get as good a grades so you are thinking you wanna two or first then they just wanna pass, and that's a bit disheartening" [P7, UOP]

"You have brought my grade down [LAUGHS]" [P10, UOP]

However, the data suggested that active learning through group work promotes higher-level thinking and skills development. This is attributed to the fact that students are active participants in the learning process. Thus, students could benefit from social interaction and peer learning.

> *"It [workshops] has helped us bond as a year better as well because like you get the opportunity to work with people that are not necessarily your friends which is nice as well"* [P7, UOP]

> *"We have a poster at the moment and we have to work in groups even though erm some people find it difficult to work in groups we have to learn that for when we do go out into the work environment so it helps us build the skills that we will need and also the presentation as well it helps our confidence if we don't do it so we won't have that confidence"* [P2, UCL]

> *"Sometimes it's quite good because it makes us think"* [P1, UCL]

> *"When I was there [in a case-based learning class] I did learn because everyone would add different facts and that was engaging"* [P11, UCL]

> *"I suppose like group work I suppose we have to learn through that way I think it is good to consolidate our knowledge at the end, because like erm last semester we had to do like .. we had to make an intervention and it was quite good to consolidate some of the knowledge that we learn"* [P8, UCL]

5.7 Discussion

The results from this study show that the learning experience of students is influenced by numerous factors. Teachers' qualities and characteristics were found to have a major impact on students' learning experience. This suggests that an effective educator is approachable, helpful, creative, motivated, confident, engaging, organised and competent. The data also identified the need to make the traditional lectures engaging, and deliver the content at an appropriate pace considering students' needs and the subject difficulty. Lectures that lacked interactivity were found to trigger student boredom and in response they lost concentration. Similarly, lectures delivered with little enthusiasm and at an inappropriate pace were found

unsatisfactory. These findings seem to be consistent with the growing body of research highlighting the limitations of the traditional lecture-based method of teaching (Biggs and Tang, 2011; Bligh, 2000; Brown, 1978; Buckridge and Guest, 2007; Davies et al., 2013; Gannod et al., 2008; McLaughlin et al., 2013; Moravec et al., 2010; Morss and Murray, 2005; Pierce and Fox, 2012; Van Dijk and Jochems, 2002).

Lecturers could improve their lectures by adopting techniques and strategies that assist in attracting students' attention and stimulating their interest. Morss and Murray (2005) proposed a number of ideas for gaining students' attention in lectures, for instance, asking a rhetorical question, using large gestures and varying the intonation of voice. In addition, they suggested incorporating strategies that encourage student involvement and change of mode, for instance, paired discussion, which involves asking students to get together in pairs and discuss a particular point. However, incorporating activities in traditional lectures leads to less material being covered and course content being reduced. This could be one reason why lecturers frequently avoid adding interactive elements to their lectures (Morss and Murray, 2005). Previous research suggests that students can maintain their attention during a lecture for a maximum of 15-20 minutes, and often remain attentive for only about 10 minutes (Bligh, 2000; Brown, 1978). Morss and Murray (2005) suggested that good lectures have the following features: clear structure; comprehensible language; interesting and engaging delivery; thought stimulating; delivered with confidence; and good delivery in terms of voice, dynamics and pace. Undergraduate university classrooms involve a large number of students with a wide range of academic capabilities (Biggs and Tang, 2011; Buckridge and Guest, 2007). Appropriately pacing the delivery of the lecture content to meet the diverse needs of these students is a challenge. Lecturers are further confronted by time constraints associated with covering a crowded curriculum (Chireshe, 2011). Previous research also indicated that the learning outcomes that can be met by traditional lectures are rather limited (Bligh, 2000). Ramsden (2003) emphasized that effective lecturing facilitates deep learning outcomes and discourages a superficial

learning environment. In addition, it maximises student academic achievement and course satisfaction (Chireshe, 2011). As was mentioned in the introduction chapter, MPharm graduates in the UK are expected to demonstrate a range of pharmacy-related cognitive and practical skills and a range of transferable skills (Table 1.6). Ultimately, the limitations of the traditional lecture highlighted in the current study provide further support for the need to replace the traditional lecture with an alternative teaching method, such as the flipped classroom, that might be more suitable in addressing its shortcomings (McLaughlin et al., 2013). In the current study, students highlighted that the flipped classroom teaching method could potentially improve their confidence, attention and engagement with the lesson. In addition, they could benefit from the lecture being paced according to their needs. Thus, further investigation of the impact of the flipped classroom on MPharm students is necessary.

Organisational issues related to the educator were highlighted, particularly in active learning environments. Within this study, students acknowledged the need to adopt organisational strategies when running teaching sessions in order to maximise students' outcomes and consequently their satisfaction. With regard to the teaching sessions that require students to complete independent learning prior to the class time, the educator needs to assign the work for students in a way that helps them to complete it. For instance, the educator could put a notice in the virtual learning environment about assigned pre-session learning in plenty of time, followed by a subsequent reminder. Previous studies that implemented and investigated the impact of the flipped classroom varied in their practice with regard to assigning the pre-work to students, and the duration between assigning the pre-work and scheduled class time ranged between two days to one week. However, the appropriateness of this duration was not examined (Critz and Knight, 2013; Lage et al., 2000; Moravec et al., 2010; Smith, 2013). The current study did not suggest a duration for assigning the pre-work; however, further work needs to be done to establish this. Another important practical implication is that the educator should plan the session activities well with respect to

dedicated session time. These findings could be explained by the core andragogical principle that adults need to know why before they engage in learning. Based on this core principle of adult learning theory, engaging adults as collaborative partners of the learning strategies satisfies their need to know and it appeals to their self-concept as independent learners. In response, according to Knowles et al. (2012), this could lead to more effective learning.

It was determined in this study that equipping students with the right learning tools is crucial for positive learning outcomes. In addition, these learning tools need to be well balanced with respect to their quantity and relevance to the subject. With respect to the lecture, the study identified the need to provide students with lecture notes during the lecture to aid in note taking. Essentially, this might help students to follow the lecture and focus on what is important. Additionally, lecturers should provide students with relevant, easy to understand learning resources that could assist in deep learning after the lecture, for instance, text-based further readings. Having access to recorded lectures was seen as positive in this study since it could overcome the challenge of inappropriate lecture pace. This finding mirrors those observed in earlier studies (Khanova et al., 2015b; Koo et al., 2016). Concerning learning environments that require independent learning and preparation prior to the session, the current study identifies an issue with the relevance of the assigned learning materials to the learning activities that take place during the session time. In plain words, the students expressed dissatisfaction with the misalignment between pre-class learning and in-class activities. This could be explained by the andragogical assumption that adult learners tend to be motivated in learning that has personal value to them (Knowles et al., 2012). Thus, students become unsatisfied with using their own time on a learning activity that is perceived to have no value to them. However, having access to iPads during the active learning sessions was appreciated since it could facilitate researching and obtaining information. Concerning the learning tools for the flipped classroom teaching approach, the current study reports a necessity to integrate the pre-class learning into

the scheduled session by providing relevant learning materials. What is more, these learning materials need to be provided to students in different formats, i.e. both text-based and audio-needs and visual, to accommodate student diversity and different learning styles.

This study confirms that learning can be emotional, and both negative and positive emotions can be experienced in different learning environments. It has been established that emotions are constantly present during adult learning. Brain research has indicated that emotional engagement during learning is necessary to maintain motivation for learning. Emotions are extremely complex, and thus it is not possible to determine their exact relationship to learning and behaviour (Wlodkowski, 1985). The current study suggests that class size could trigger students' emotions. Large classes were perceived as an emotionally threatening factor that promotes students' disengagement due to shyness or fear of embarrassment in front of a large number of people. Conversely, small class environments were found to be emotionally safer and to encourage student participation. New or challenging learning environments that require students to work out of their comfort zone, such as simulation workshops, could trigger negative emotions and be faced with resentment initially. Based on this view, the students suggested introducing the flipped classroom teaching method into the early years of the MPharm curriculum to allow for student adjustment. Wlodkowski (1985) claims that motivated adults often experience negative emotions such as anxiety, worry, doubt and apprehension in their efforts towards learning and non-learning goals. However, desiring something, believing in its value and having the confidence to achieve it transforms the discomfort into an acceptable and endurable reality. Therefore, the educator's primary goal is not to make the learning pain free, but rather to make it worth the discomfort it may require. In addition, providing motivational and emotional influences could support and nurture learners through the challenges inherent to attaining excellence in achievement. It is worth noting that emotional reactions can be influenced by four different sources: personal mood, the educator, the learning process and material, and finally the learning group

(Wlodkowski, 1985). Educators should therefore take students' emotions into consideration and aim to maintain an optimal emotional climate. In terms of the learning process, the flipped classroom teaching method could serve as a positive teaching tool that might overcome the challenges of the traditional lecture approach in addressing learners' negative emotions for various reasons. Firstly, the foundation knowledge gained outside the class time could boost students' confidence, and consequently their engagement with the class activities, while also reducing anxiety. Secondly, the contact time is normally spent on going through learning activities in small groups, and students could potentially benefit from having the lecturer as 'a guide on the side'.

Concerning the learning activities that involved group work, the students showed two varying attitudes towards assessed and non-assessed group work. Students were mainly satisfied with non-assessed group work as it was seen advantageous. In a way, students are active participants in the learning process that encourages higher-order thinking, peer-learning and skills development. However, assessed group work was seen as unfavourable. This was due to group members' varying levels of contribution to a task in which every student is awarded the same grade. Thus, group assessment should measure individual input. Davis (1993) described three categories of group work: informal learning groups, formal learning groups and study teams. Informal learning groups are temporary groups of students brought together in a single class session, for example, to discuss a point raised in a lecture. Conversely, formal learning groups are defined as teams established to work on and complete a particular task or assignment that might take several weeks until the assignment is marked. Study teams are groups with a stable long-term membership whose main duty is to support, encourage and assist group members in completing course tasks and requirements (Davies, 2009; Davis, 1993).

The literature suggested that one of the main issues of group work is motivation of group members (Davies, 2009; Kerr, 1983). 'Social loafing' and

‘free riding’ are two common examples of motivational problems associated with group work (Davies, 2009; Latane et al., 1979; Ruël et al., 2003; Strong and Anderson, 1990). ‘Social loafing’ describes a reduction in effort exerted by a person when working in a group due to lack of identification in a group task (Davies, 2009; Ohlert and Kleinert, 2013). Davies (2009) pointed out that social loafing can lead to free riding, which involves the issue of a non-performing group member gaining benefits from other members’ effort but with little or no contribution to the task. In other words, free riding means achieving reward for little or no effort (Davies, 2009). Ultimately, social loafing and free riding were found in the current study to be associated with assessed group work in which individual members’ contributions are not considered in its assessment criteria. Consistent with previous research, this study confirms that social loafing could negatively impact group members who carry the weight of the group. For instance, the presence of social loafers within a group task may force other group members to work harder to compensate for their lack of performance. In addition, this might create negative feelings and frustration towards the social loafers and the group task. In response, this could negatively impact students’ satisfaction regarding the fairness of assessment (Aggarwal and O’Brien, 2008) or have an impact on their final grade.

The current study indicated that there is a difference between the traditional lecture and the flipped classroom teaching method with respect to achieving the intended learning outcomes through the scheduled class time. The traditional lecture approach usually guarantees, to some extent, knowledge acquisition without needing to prepare before turning up for the lecture, as the lecturer is responsible for preparation and delivering the information to students. In addition, students can take advantage of having peer support and face-to-face contact with their lecturer. Thus, the traditional lecture approach is associated with ease, since students are normally expected to simply turn up to the class and listen to the lecturer. On the other hand, preparation for the contact time is crucial for academic gain in the flipped classroom teaching approach. Expressed differently, students are

accountable for completing the pre-class learning in order to achieve the learning outcomes from the scheduled flipped session. Allowing students to take ownership of their learning through the flipped classroom approach is expected to develop a pharmacist's professional attributes such as independent study skills, time management and organisation skills. However, motivating students to prepare is essential, and high workload could be a potential barrier for pre-class independent learning.

Similar to what has been observed in previous research, this study suggests that scaffolding the delivery of teaching through the flipped classroom could potentially help students to adopt a deep approach to learning (Galway et al., 2014; Khanova et al., 2015b; Love et al., 2013; Muzyk et al., 2015). In other words, the flipped classroom teaching approach could overcome the tendency to adopt a surface approach to learning that is common with the traditional lecture method. Developing the skills and abilities that are expected from MPharm graduates requires deeper learning and a greater level of cognitive processing. The current study also highlighted positive satisfaction towards active learning environments that are relevant to pharmacy students' anticipated workplace experience. In addition, educators should align the intended learning outcomes of the course with an appropriate method of delivery.

5.8 Chapter summary

Key findings of the study suggested that the learning experience of MPharm students is influenced by several factors. Teachers' qualities and characteristics were a major factor in MPharm students' learning experience. There was a perceived need to engage students with the learning process in the traditional lecture classes, and to deliver the content at a pace that takes into account student needs and subject difficulty. In addition, the study identified a need to ensure that active learning sessions are well planned and organised, particularly with respect to assigning the pre-work and planning the session activities with relation to the session time. Providing the right learning tools that complement each instructional method was found a key

for positive student outcomes. As learning can be emotional, it seemed there is a need for educators to consider students' emotions, especially in learning environments that are perceived as emotionally threatening. Large classes, such as those used commonly for traditional lectures, were perceived as an emotionally threatening factor that leads to students' disengagement due to shyness or fear of embarrassment in front of a large number of people. Conversely, small class environments were found to be emotionally safer and to encourage student participation. Learning activities that involve assessed group work were seen as unfavourable due to unequal input from some group members when all are awarded the same grade. Thus, individual input must be considered in group assessment to reduce emotions such as frustration. However, non-assessed group work was well perceived since it was thought to contribute positively to learning and skills development.

The current study reported that the flipped classroom teaching approach could potentially serve as a positive tool to overcome the present challenges of the traditional lecture. Firstly, students could pace the online lecture according to their needs. Secondly, preparing for the contact time might potentially help students to improve their confidence, attention and engagement with the lesson. Additionally, sequencing the learning activities in the flipped classroom pedagogy was expected to assist students in adopting a deeper approach to learning, which is not normally achieved by the traditional lecture method. The study also showed that, unlike the traditional lecture, the flipped classroom pedagogy might possibly encourage students to take ownership of their own learning and consequently develop the professional attributes required to be a pharmacist. However, motivating students to complete pre-class learning is essential, and high workload could be a potential barrier for preparation. With regard to learning material for the flipped classroom approach, the students emphasised that the pre-class learning has to be relevant to and integrated into the learning activities for the scheduled session. In addition, these learning tools need to be offered in different formats in order to satisfy the different learning styles of students. In

order to allow for student adjustment to the flipped classroom teaching method, the students suggested using this instructional method from the early years of the MPharm curriculum.

Chapter 6 Stage II Method

This chapter describes the methods undertaken to achieve the aims and objectives of the second phase of this research. It starts by reporting the study aims and objectives. It then goes on to presenting the selection and assignment of the participants, the instrumentation and materials, the experimental procedures, the sampling for the qualitative study, data collection procedures, and finally it provides the researcher's reflection on the teaching sessions.

6.1 Aim and Objectives

6.1.1 Aim

Phase I: Quantitative study

To determine the impact of the flipped classroom teaching method on MPharm students in relation to satisfaction and knowledge acquisition.

Phase II: Qualitative study

To explore the feasibility and acceptability of a flipped classroom with MPharm students

6.1.2 Objectives

Phase I: Quantitative study

1. To determine the impact of the flipped classroom on students' knowledge acquisition.
2. To compare the learning environments of a flipped class with a traditional lecture-based class.
3. To compare students' satisfaction with a flipped class with a traditional lecture-based class.
4. To determine whether students' learning style influences their perception of the flipped and traditional teaching approaches.

Phase II: Qualitative study

1. To evaluate students' satisfaction with and attitude towards the flipped classroom instructional model.
2. To document the challenges linked to implementation of the flipped classroom.
3. To ascertain ways to improve the flipped classroom pedagogical method.

6.2 Methods

The design chosen to conduct this study is a quasi-experimental, mixed methods design. A justification for this research approach is provided in section 3.3 of the methodology chapter. The study was conducted during the academic year 2015/2016 (refer to section 3.4.1 for the study setting).

6.2.1 Selection and assignment of participants

The study participants were MPharm students enrolled on year four of the MPharm programme in the academic year 2015/2016. The rationale for selecting this particular group of the MPharm programme is indicated in section 3.1.5. A non-random sampling (opportunity sampling) was employed to assign the students to the flipped classroom (experimental group) and the traditional lecture (the control group) groups. In both pharmacy institutions, the MPharm cohort is normally divided into a number of small groups with different timetables. Each group is identified by a letter of the alphabet and contains between 18 and 20 students. These groups are merged together for optional modules and large classroom lectures and separated for small classes such as workshops.

At UOP, groups A, B and C were allocated to the lecture group (55 students), and D, E and F were allocated to the flipped classroom group (55 students). A similar procedure was followed at UCL, where groups A, B, C and D (83 students) were assigned to the lecture group, and E, F, G and H (80 students) were assigned to the flipped classroom group (Figure 6.1). The

students were reminded to attend their allocated teaching session; however, moving between the groups was allowed with permission from the lecturer.

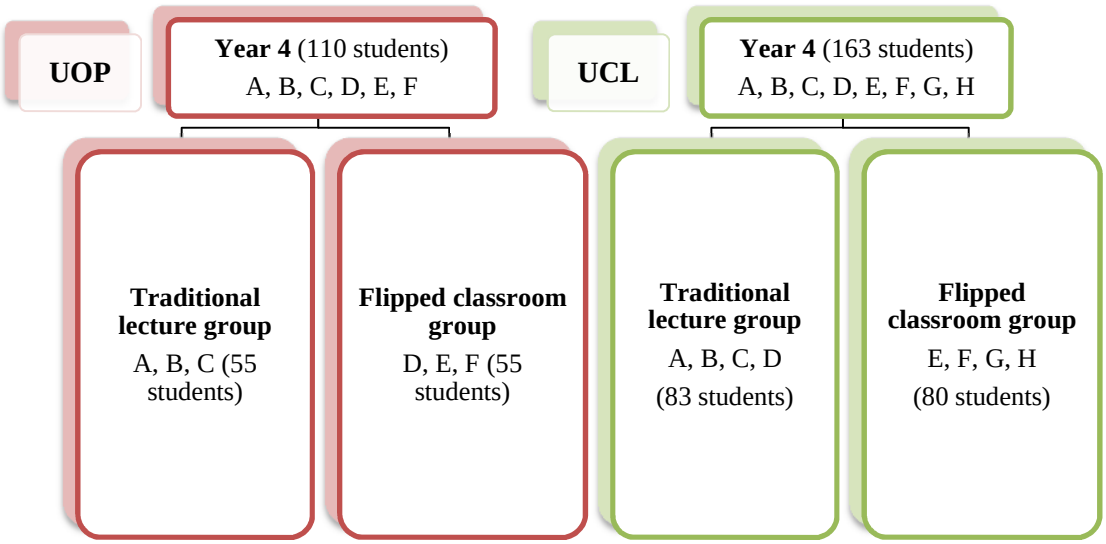

Figure 6.1: Allocation of the Students into the Traditional Lecture and the Flipped Classroom Groups at UOP and UCL

6.2.2 Instrumentation and materials

6.2.2.1 The questionnaire

A questionnaire was developed to collect data from the students who attended the rheumatoid arthritis teaching sessions. The questionnaire for both the flipped classroom and the traditional lecture group included the following main sections: demographic information (age, gender, first language), perception of the classroom psychological environment, the overall session rating (satisfaction), and the Kolb learning style test. Student identification (ID) number was requested in the questionnaire in order to make it feasible to withdraw any data from the research. Engagement with the pre-lecture materials is an additional section, which was added to the flipped classroom questionnaire. Refer to Appendix 8 and Appendix 9 for the questionnaire for the traditional lecture and the flipped classroom groups respectively.

The College and University Classroom Environment Inventory (CUCEI) was adapted to assess seven dimensions of the actual classroom environment: personalisation, involvement, student cohesiveness, satisfaction, task orientation, innovation and individualisation. The CUCEI comprises a total of 49 items in which each of the seven sub-scales has seven items. Each item is responded to on a 4-point Likert scale that is strongly agree, agree, disagree and strongly disagree. About half of the items have a reversed scoring scale (Fraser and Treagust, 1986). Refer to Appendix 10 for the actual form of the CUCEI. The 49 items of the CUCEI are arranged in seven blocks. Each block is arranged to represent each of the seven sub-scales in the following order: personalisation, involvement, student cohesiveness, satisfaction, task orientation, innovation and individualisation. Items are scored 5, 4, 2 and 1 respectively for the responses strongly agree, agree, disagree and strongly disagree. Underlined items are scored in the reverse manner. Omitted or invalid responses are scored 3 (Fraser and Treagust, 1986). Table 6.1 explains the meaning of each scale of the CUCEI. Validation of CUCEI was conducted on a sample of 307 students in a wide range of undergraduate and postgraduate classes. The data suggested that each sub-scale of the CUCEI has adequate internal consistency reliability, with Cronbach's alpha coefficients ranging from 0.70 to 0.90. In addition, each sub-scale of the CUCEI has adequate discriminate validity; this was manifested by the small mean correlation with the other six sub-scales (Fraser, 1998; Fraser and Treagust, 1986). The internal consistency reliability examines how well the items on a particular test measure the same construct or concept. The discriminate validity, on the other hand, is concerned with ensuring that concepts that are meant not to be related are actually unrelated (Robson, 2011).

Table 6.1: CUCEI Scales' Description

Scale name	Scale description	Sample item
Personalisation	Emphasis on opportunities for individual students to interact with the instructor and on concerns for students' personal welfare	The instructor goes out of his/her way to help students (+)
Involvement	Extent to which students participate actively and attentively in class discussions and activities	The instructor dominates class discussions (-)
Student cohesiveness	Extent to which students know, help and are friendly towards each other	Students in this class get to know each other well (+)
Satisfaction	Extent of enjoyment of classes	Classes are boring (-)
Task orientation	Extent to which class activities are clear and well organised	Students know exactly what has to be done in our class (+)
Innovation	Extent to which the instructor plans new, unusual class activities, teaching techniques and assignments	New and different ways of teaching are seldom used in this class (-)
Individualisation	Extent to which students are allowed to make decisions and are treated differentially according to ability, interest, of rate of working	Students are allowed to choose activities and how they will work (+)

The existing actual form of the CUCEI was modified to fit the study context including the British English language, the one session evaluation, and the lecture format. The wording of the items was changed from third person singular to first person singular, and the verbs were changed from present tense to past tense. Additionally, “instructor” was rephrased as “lecturer”. For example, the item “The instructor considers students' feelings” was modified into “The lecturer considered my feelings”. The following three items were deleted, as they are not applicable to one-session evaluation: “It takes a long time to get to know everybody by his/her first name in this class”, “The seating in this class is arranged in the same way each week”, and “Students seem to do the same type of activities every class”. One item “Teaching approaches in this class are characterised by innovation and variety” was separated into two items, as it is a double-barrelled question that touches upon more than one matter but allows for only one answer. Table 6.2 illustrates the modifications made to the CUCEI.

Table 6.2: Adaption of the CUCEI

Scale name	Original item	Adapted item
Personalisation	1. The instructor considers students' feelings	The lecturer considered my feelings
	2. The instructor talks individually with students	The lecturer talked individually with me
	3. The instructor goes out of his/her way to help students	The lecturer went out of his/her way to help me
	4. The instructor helps each student who is having trouble with the work	The lecturer helped me when I was having trouble with the work
	5. The instructor seldom moves around the classroom to talk with students	The lecturer seldom moved around the lecture theatre to talk to me
	6. The instructor isn't	The lecturer was not interested

Scale name	Original item	Adapted item
	interested in students' problems	in my problems
	7. The instructor is unfriendly and inconsiderate towards students	The lecturer was unfriendly and inconsiderate towards me
Involvement	1. The instructor talks rather than listens	The lecturer talked rather than providing an opportunity to ask questions
	2. Students put effort into what they do in classes	I put effort into what I did in the lecture
	3. Students "clockwatch" in this class	I “clockwatched” in this lecture
	4. Students in this class pay attention to what others are saying	In this lecture, I paid attention to what others were saying
	5. Students seldom present their work to the class	I seldom presented my work to the class
	6. There are opportunities for students to express opinions in this class	There were opportunities for me to express my opinion in this lecture
	7. The instructor dominates class discussions	The lecturer dominated the discussion during the lecture
Student cohesiveness	1. The class is made up of individuals who don't know each other well	The lecture was made up of students who do not know each other well
	2. Each student knows the other members of the class by their first names	I know most students in the lecture by their first names

Scale name	Original item	Adapted item
	3. Friendships are made among students in this class	Friendships were made with other students in this lecture
	4. Students don't have much chance to get to know each other in this class	We didn't have much chance to help each other in this lecture
	5. It takes a long time to get to know everybody by his/her first name in this class	Omitted
	6. Students in this class get to know each other well	In this lecture, I had the chance to get to know my classmates well
	7. Students in this class aren't very interested in getting to know other students	In this lecture, I was not very interested in getting to know other students
Satisfaction	1. The students look forward to coming to classes	I look forward to coming to similar lectures
	2. Students are dissatisfied with what is done in the class	I am dissatisfied with what was done in the lecture
	3. After the class, the students have a sense of satisfaction	After the lecture, I had a sense of satisfaction
	4. Classes are a waste of time	The lecture was a waste of time
	5. Classes are boring	The lecture was boring
	6. Students enjoy going to	I enjoyed going to this lecture

Scale name	Original item	Adapted item
	this class	
	7. Classes are interesting	The lecture was interesting
Task orientation	1. Students know exactly what has to be done in our class	I knew exactly what was going to happen in our lecture
	2. Getting a certain amount of work done is important in this class	Getting a certain amount of work done was important in this lecture
	3. The group often gets sidetracked instead of sticking to the point	I was daydreaming in this lecture rather than concentrating
	4. This is a disorganised class	This was a disorganised lecture
	5. Class assignments are clear so everyone knows what to do	Lecture assignments were clear so I knew what to do
	6. This class seldom starts on time	This lecture did not start on time
	7. Activities in this class are clearly and carefully planned	Activities in this lecture were clearly and carefully planned
Innovation	1. New ideas are seldom tried out in this class	New ideas were tried out in this lecture
	2. New and different ways of teaching are seldom used in this class	New and different ways of teaching were seldom used in this lecture
	3. The instructor thinks up innovative activities for students to do	The lecturer thought up innovative activities for me to do

Scale name	Original item	Adapted item
	4. Teaching approaches in this class are characterised by innovation and variety	Teaching approaches in this lecture were characterised by innovation
	5. The seating in this class is arranged in the same way each week	Omitted
	6. The instructor often thinks of unusual class activities	The lecturer thought of unusual class activities
	7. Students seem to do the same type of activities every class	Omitted Teaching approaches in this lecture were characterised by variety
Individualisation	1. All students in the class are expected to do the same work, in the same way and in the same time	All students in the lecture were expected to do the same work, in the same way and in the same time
	2. Students are generally allowed to work at their own pace	The pace of the lecture met my needs
	3. Students have a say in how class time is spent	I had a say in how the lecture time was spent
	4. Students are allowed to choose activities and how they will work	I was allowed to choose activities and how I would work
	5. Teaching approaches allow students to proceed at their own pace.	Teaching approaches allowed me to proceed at my own pace
	6. There is little opportunity	There is little opportunity for

Scale name	Original item	Adapted item
	for a student to pursue his/her particular interest in this class	me to pursue particular interest in this subject
	7. It is the instructor who decides what will be done in our class	It was the lecturer who decided what would be done in our lecture

*Underlined items are scored in the reverse manner

The next section of the questionnaire requested information on the overall rating of the teaching format used. There were five responses, ranging from excellent to poor. The Kolb Learning Style Inventory (version 3.1) was added to the questionnaire in a separate section to find out about the learning style of students, whether it is diverging, assimilating, converging or accommodating (Kolb, 1993). The Learning Style Inventory (LSI) was created to measure the differences in the learning styles of individuals based on the experiential learning theory. Version 3.1 of the LSI consists of 12 items that require respondents to rank four sentence endings that correspond to the four learning modes of the Kolb experiential learning cycle model: Concrete Experience (e.g. experiencing), Reflective Observation (e.g. reflecting), Abstract Conceptualisation (e.g. thinking) and Active Experimentation (e.g. doing). Thus, it is constructed in a way that allows individuals to respond to it as they would in a particular learning situation. In other words, it requires individuals to resolve the tensions between the active-reflective and abstract-concrete orientations. The LSI measures a total of six factors; four main scores measure an individual's relative emphasis on the four learning modes: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualisation (AC), and Active Experimentation (AE); the other two are combination scores that measure an individual's preference for action over reflection (AE-RO) and abstractness over concreteness (AC-CE). Cronbach's alpha coefficients for the scale scores of the LSI have been

measured in a number of studies, and the findings suggested that the LSI has a good internal consistency reliability (Kolb and Kolb, 2005b).

Engagement with the pre-flipped session materials was measured by four questions added to the questionnaire pack given to those who attended the flipped classroom. These questions covered whether or not students completed the assigned pre-work, and what assigned pre-lecture materials they completed. Additionally, this section investigated how many days prior to the flipped session the students carried out the assigned pre-work, and how much time they spent on it.

6.2.2.1.1 Permission to use the CUCEI and the Kolb Learning Style Test

In order to comply with the copyright restrictions, permissions for using validated measures were sought. Permission for adapting the CUCEI was granted by email from Professor Barry Fraser, School of Education, Curtin University, Australia, on the 14th October 2014. An application for using the Kolb Learning Inventory was submitted to HayGroup, which is the copyright owner of this research tool. The application was approved by the research committee, and access to the paper-based version 3.1 Kolb Learning Style Inventory was granted free of charge. A conditional use agreement form (Appendix 11) was signed by the researcher and sent to HayGroup by fax.

6.2.2.2 The development of the topic guide schedule

The topic guide schedule (Appendix 12) for the focus groups was developed to encourage participants to talk freely about their experience and perception of the flipped classroom teaching method. The content of the interview guide was informed by the study aims and objectives. A total of 10 questions were included in the final version of the topic guide. The questions were composed in a logical order progressing from general to specific, but also allowing for probing and clarification. The first question (‘Tell us your name, and tell us which area of pharmacy you want to work in after graduating?’) was an opening question and it was intended to make focus group participants feel comfortable at the beginning of the discussion (Côté-Arsenault and Morrison-Beedy, 1999). The next three questions addressed students’ experience with

a flipped classroom session using ‘think back’ questions (Krueger and Casey, 2015). Another question examined students’ viewpoints with regard to further use of the flipped classroom teaching method in the MPharm curriculum. The subsequent three questions were designed to investigate the perceived impact of the flipped classroom on students’ learning, assessment and being a pharmacist. The next question was intended to encourage participants to share their advice and suggestions related to any aspect of the rheumatoid arthritis flipped session. The final question was included to welcome any further thoughts or views from the participants. The content of the topic guide schedule was reviewed by the research team and piloted with two MPharm students. The researcher followed the same piloting procedures presented in section 4.2.1. No amendments were made following the piloting.

6.2.2.3 The teaching materials and the formative test

Because the teaching sessions in every pharmacy institution were delivered by a different lecturer, and in an attempt to minimise the variation in the content of the teaching sessions between the two pharmacy schools, the researcher developed a standardised teaching tool on rheumatoid arthritis for both the lecture and the flipped classroom groups. This included the following: a lesson plan, lecture notes in the form of PowerPoint slides, post-video quiz for the flipped classroom group, case study for the flipped classroom group, formative assessment, and references for further reading. In addition, the researcher collated all the references from which the lecture slides were written, so the lecturer could refer to them when preparing for the teaching. The formative assessment consisted of 10 multiple-choice questions, each one containing five options. The test was designed to assess student learning, and it was constructed based on the objectives of the rheumatoid arthritis session. The assessment was delivered using TurningPoint technology that enabled the students to submit anonymised answers. The teaching materials were reviewed and approved by members of the pharmacy practice teaching staff at UOP and UCL.

6.2.2.3.1 The pilot flipped classroom teaching session

In order to test logistics before conducting the full-scale study, the principal researcher ran a flipped classroom-style pilot teaching session on rheumatoid arthritis with a small group (n=4) of year four MPharm students at UCL School of Pharmacy in March 2015. The flipped teaching session was delivered in two stages. The first stage involved developing online resources, and the second stage was facilitating an interactive session with students. The researcher prepared PowerPoint slides on rheumatoid arthritis and, with the aid of Camtasia®, she recorded her lecture onto the slides. Camtasia® allowed for editing of the recording by cutting out mistakes and removing noise. The lecture was uploaded to Moodle, and an online multiple choice quiz was created so students could reinforce their learning and assess their understanding of the topic. For the session activities, case studies on a rheumatoid arthritis and a formative TurningPoint quiz were prepared. The recorded lecture and the quiz were made available online a week before the class meeting. References to further reading were also included.

The researcher acted as a facilitator for a 90-minute long active flipped session with four students. In order to make the students clear about what to expect from the session and how to best achieve the intended learning outcomes, she asked them to either view the online lecture or complete some reading from the suggested references. She also encouraged them to attempt the online quiz to reinforce their learning and assess their understanding of rheumatoid arthritis. She mentioned to them that they were going to discuss case studies on rheumatoid arthritis during the session time, and they were asked to bring along their BNF (British National Formulary) and any questions that they might have. Looking at students' responses to the online quiz before the session indicated that they were well prepared for the class activities. Since the researcher did not have regular teaching responsibilities with year four students, she started off the session by introducing herself to the students and having a brief chat with them about the pre-class preparation. The researcher felt that the informal chat with students helped to get everyone talking. After that, the researcher described

the structure of the session and explained that they were going to go through different case studies for a rheumatoid arthritis patient. She read out the first part of each case study and asked students to discuss it in pairs; she rotated around the groups to listen to students' discussion and to assist those who needed help. Students were then asked to share their responses with the entire class and were given immediate feedback. The researcher felt that students were engaged with the discussion and were keen to ask questions. To finish off the session, TurningPoint technology was used to go through formative multiple-choice questions with the students. Each question and its five options were displayed on the classroom's projector screen, and then the students were asked to submit their answers. The class responses were then shown in percentages, then the right answer was given, and finally feedback was provided. The researcher spent a few minutes with the students at the end of the session to informally seek their views on the session. The students indicated that they appreciated the TurningPoint questions and enjoyed how the session was structured.

6.2.3 Experimental procedures

6.2.3.1 The control group

The teaching session for the control group was delivered using the traditional lecture-based format. Lecture notes and recommendations for further reading were posted on Moodle a day before the lecture for the UOP group, and were given to students at the beginning of the lecture at UCL. This was informed by the existing practice followed in each pharmacy institution.

6.2.3.2 The experimental group

A flipped classroom teaching method was used to deliver the teaching session for the experimental group. Designing the teaching session in a flipped classroom format was informed by two main findings from stage I (Chapter 5). The first finding was the need to carefully plan learning sessions, specifically in terms of assigning the pre-work and designing the session activities in relation to the available session time. The pre-session assignment needs to be publicised in a way that helps students to complete

it, for example, by allowing enough time for the task and making sure to remind students about the assigned pre-work. The second finding that informed this stage was the need to provide students with the right learning tools, considering the relevance of the learning materials to what is being learnt and also offering these materials in both an audio-visual and a text-based format.

For the experimental group, a recorded lecture was made available online for students to view at their own pace five days before the scheduled flipped active session. UOP's lecturer recorded his lecture using the e-learning facilities available at UCL SOP. For the UCL SOP experimental group, however, the control group's live traditional lecture was recorded for the flipped classroom group. The recording and editing of lectures for this study were facilitated by the e-learning coordinator at UCL SOP.

In order to reinforce students' learning, a formatively graded online interactive quiz was utilised. The quiz consisted of 10 multiple-choice questions, and it was created on Moodle. The students were able to receive immediate feedback on each question, including whether the submitted response was correct or incorrect, the correct answer, and a brief explanation that supported the correct answer. Evidence from teaching and learning research has indicated that feedback is perhaps the most important activity for enabling learning. Formative assessment, for example, allows the learner to identify the gap between a desired goal and their current state of knowledge, and/or understanding, and/ or skill. Consequently, the learner can take action to close the gap in order to achieve a desired goal (Black and Wiliam, 1998). Students were also given a list of recommended reading materials. The scheduled class time was spent on engaging students in various learning activities.

The students were encouraged to take notes while listening to the online lecture, as well as documenting any questions or queries. The first 15 minutes of class were allocated for discussing students' questions and re-capping the key points of the online lecture. The next 45 minutes were

allocated for engaging students with case studies on a rheumatoid arthritis patient. The case study involves different scenarios for a rheumatoid arthritis patient, with a total of seven questions that need to be addressed by a community pharmacist. The case study targets a range of cognitive domains of Bloom's revised taxonomy including remembering, understanding, applying and analysing.

6.2.4 Sampling for the qualitative study

6.2.4.1 Sampling strategy

A purposive sampling approach was employed in the qualitative study in order to target a sub-sample of students who had experienced the flipped classroom. Thus, year four MPharm students who attended the rheumatoid arthritis session in a flipped classroom format in the academic year 2015/2016 were invited to participate in this part of the study. A rationale for the sampling strategy is presented in section 3.4.2.

6.2.4.2 Sampling procedure and the recruitment of the focus group participants

A number of strategies were followed to recruit the focus group participants. The first approach was recruiting through advertising (Krueger and Casey, 2015). This involved making announcements after the flipped classroom sessions and on Moodle to invite students to take part in the focus groups. This resulted in the recruitment of a small number of participants, i.e. two students from UOP and one from UCL. The next strategy used was snowball sampling, which involved asking the participants to recruit other participants who had attended the flipped classroom session (Krueger and Casey, 2015). At this stage, a further four students were recruited at UCL SOP and none at UOP. Another step taken was sending personalised invitation emails to all the potential participants. This in turn led to the recruitment of four additional participants at UOP and two at UCL SOP. The total number of participants who were recruited for the focus groups was six students at UOP and seven at UCL.

6.2.5 Data collection – Procedure

6.2.5.1 Administration of the questionnaire

A hard copy of the questionnaire was administered to students by the principal researcher during the last half an hour of each scheduled teaching session. Before administering the questionnaire, the researcher introduced herself to the students and mentioned that the teaching session was delivered as part of her PhD research. She then revealed to which group they had been assigned, and described the project and what was required to participate in the study. Then, each student was given a plastic pocket containing the following documents: information sheet (Appendix 13 and Appendix 16), consent form (Appendix 14 and Appendix 17), questionnaire (Appendix 8 and Appendix 9) and participant debrief sheet (Appendix 15 and Appendix 18). The students were asked to complete the questionnaire and then read through the information sheet and the consent form, and to return the questionnaire and the signed consent form if they were happy for their data to be included in our study. The researcher moved around the room to assist students who needed help with completing the questionnaire.

6.2.5.2 Conduct of focus groups

Focus groups were conducted and moderated by the principal study investigator. Two focus group sessions were conducted, i.e. one in each pharmacy institution. At UOP, only four participants out of six turned up for the focus group session. Five out of seven students turned up for the session at UCL SOP. Each session took approximately 60 minutes to conduct. The researcher adopted the same steps followed in conducting the focus groups presented in Chapter 4. Further details on conducting the focus groups are presented in section 4.2.2.3.

6.3 Reflective journal of rheumatoid arthritis teaching sessions

This section reports in detail how the rheumatoid arthritis teaching sessions were delivered in both pharmacy institutions, from the lens of an observing researcher. The principal researcher attended and observed all teaching sessions delivered as part of the flipped classroom research to take notes and monitor the implementation of the experiment. The following two sessions were delivered at the University of Portsmouth School of Pharmacy by a male senior lecturer who joined the Pharmacy Practice Department in October 2014.

Wednesday 30th September 2015 (Group A, traditional lecture, University of Portsmouth)

This teaching session was timetabled for 1 pm to 3 pm in SM1.01, which is a lecture theatre located in the basement of St. Michael's building. Students at the University of Portsmouth School of Pharmacy are used to receiving electronic copies of lecture notes beforehand so they can print out a copy to bring to the class if they wish to. This session was delivered in a usual lecture format followed by a formative assessment using TurningPoint technology. The lecturer started the lecture by taking the register by passing students a registration sheet to sign. Out of 55 students a total of 43 attended the lecture, among them one student from group B who was not able to attend his assigned group the following week. The size of the lecture theatre in respect to the number of attendees felt about right, as students occupied the first four rows.

With the aid of PowerPoint slides, the lecturer focused predominantly on presenting the content of the topic to the students with minimal effort to engage them with the lecture. However, every now and then he asked them if they had any questions. Only one student asked a question and he provided a clear response instead of returning that question to other students to guess the answer. I felt the pressure was off the lecturer as he started introducing the second part of the session, i.e. the 10 multiple choice

questions that were the formative assessment. This could be due to the lecturer's personal preference for a more interactive learning environment and a discomfort with traditional lecturing. Each question and its five options were displayed on the classroom's projector screen. The lecturer read every question out loud for the students without reading out the answers, and then he asked them to submit their responses. When the time was up, the lecturer displayed the students' responses in percentages. Finally, the lecturer revealed the correct answer and provided the students with feedback if necessary. Then he repeated the same process for the next nine questions.

The last 30 minutes of the session was devoted to data collection. I started by introducing myself to the students, and I mentioned that this session had been delivered as part of my PhD research and they had been assigned to the lecture group. Then, I briefly described our project and what was required to participate in the study. I gave each student a plastic pocket contained the following documents: participant debrief sheet, survey, information sheet and consent form. I asked them to complete the survey and then read through the information sheet and the consent form, and to return the surveys and the signed consent form if they were happy for their data to be included in our study. I moved around to assist students who needed help with completing the survey.

Tuesday 6th October 2015 (Group B, flipped classroom, University of Portsmouth)

This flipped classroom-style teaching session was scheduled between 10 am and 12 noon in the main lecture theatre of the Richmond building. The lecturer sent students an email five days before the scheduled class asking them to carry out some pre-class work, which included listening to a recorded lecture and completing an online quiz which was available on Moodle. He also posted a list of references and further reading if anyone wished to read around the topic. He informed them that he would go through case studies with them; therefore, he reminded them to bring along their BNFs and

TurningPoint keypads. Parallel to the previous week's session, the first 90 minutes were devoted to teaching, and the final 30 minutes to data collection.

A total of 57 students turned up for the session. The lecturer started the session by giving students two handouts, one of the video lecture slides and for the other on a case study. Then, he described the structure of the session and what they were going to do. The lecturer read out the first part of the case study, and asked the students to work in small groups of two or three students and discuss the first three questions. He allowed three minutes for each question, but the students found that it was not enough and so asked for extra time. After that, he asked students to share their answers with the entire class. He identified students by name if no one volunteered to present their answers. He provided students with immediate feedback after receiving their responses.

The lecturer followed the same structure for the next four parts of the case study. I felt that students were enthusiastic and engaged with the discussion. However, a number of students were sat on the back rows of the lecture theatre and they were a bit out of reach and seemed not very eager to participate in the discussion. After the case study discussion came to the end, the lecturer asked the students if they had any questions. No one asked any question, so the lecturer moved on to the TurningPoint formative assessment. The lecturer acted similarly to the previous week's session for this section of the teaching. At the end, he asked the students whether or not they had enjoyed the session, and a group of students mentioned that they had enjoyed it more than the normal lecture and they wished that more lectures could be structured in this format. One of the students asked if we could have posted the lecture notes in a printable format on Moodle in addition to the video lecture, as he found it time consuming to take notes while viewing the video lecture. I would totally agree with the student's point of view, and we will consider this feedback for future teaching sessions. I sensed that the lecturer was more comfortable and more confident with running interactive sessions than with giving traditional lectures. However, I

felt that the lecture theatre was a barrier to fully engaging students for a number of reasons. First, it was not possible for the lecturer to move around freely and monitor students' progress with the activity. Second, the students sitting on the back rows were not engaged with the entire class discussion. In addition, membership of the small groups required to work on the case studies was restricted to students sitting next to each other.

We faced an issue when we used TurningPoint technology to deliver the formative assessment in both sessions at University of Portsmouth. Almost half of the students who attended forgot to bring their TurningPoint keypads to the class, despite being sent two reminders. This will be different at UCL School of Pharmacy as there are fixed TurningPoint buttons in one of the lecture theatres, and a total of 100 spare keypads that could be available by request in any teaching room.

The two classes below were delivered a week apart in UCL School of Pharmacy by a female teaching fellow who had recently joined the Research Department of Practice and Policy. Both teaching sessions were held in the Mapplethorpe Lecture Theatre from 2-4 pm. This lecture theatre has been recently furnished with brand-new node chairs that have a swivel seat, a rotating table and a storage area. The design of the node chairs enables a quick shift between different teaching modes such as traditional lecture and active learning.

Wednesday 14th October 2015 (Group A, the traditional lecture, UCL School of Pharmacy)

This session was delivered in a lecture format with identical structure to Portsmouth's session. Out of 83 students, 42 attended the lecture. We gave each student a handout of the lecture slides. The lecturer began by explaining to students that this was a CPD session, and she encouraged them to take a look at the list of references and further reading available online or at the library. I believe that the lecturer was very engaging; she asked the students many questions, and the students responded. She was

also good at handling students' queries and she tended to guide them instead of promptly answering their questions. I found that she also tried to link and refer students back to their previous lectures that covered related content.

Unlike at the University of Portsmouth, spare TurningPoint keypads are available to use by request if this technology is not available as fixed buttons in the teaching room. Before moving on to the formative assessment, we handed each student a keypad to use and return at the end of the session. The lecturer read each question and its options out loud, and then she gave the students a few seconds to submit their answers. After that, she disclosed the group responses in percentages and finally she gave the right answer with brief feedback. The last half an hour of the session was spent on data collection.

Wednesday 21st October 2015 (Group B, the flipped classroom, UCL School of Pharmacy)

Thirty-eight students attended this flipped classroom-style session. As for the University of Portsmouth, the pre-session teaching materials were available on Moodle five days prior to the class meeting. This time we also uploaded a PDF file containing the PowerPoint slides. Therefore, students could print out their own copy and use it when viewing the video lecture. At the beginning of the session, the lecturer asked the students how many of them had viewed the recorded lecture; almost two-thirds of them put up their hands. Therefore, about a third of them had not prepared for the session. However, the lecturer was good at keeping them involved in the session by encouraging them to use their residual knowledge from previous years.

The lecturer spent the first few minutes explaining how the session had been designed and answering students' questions. Only one student asked a question, which then opened up a discussion about comorbidities of rheumatoid arthritis. Next, the students worked on a case study in small groups of two to four. The lecturer advised those who had not done the pre-

session work to join students who had done the preparation, so they could cooperate and help each other. The lecturer was very dynamic; she moved around the class and tried her best to speak to every group. I felt that the flexibility of the lecture theatre facilitated the active learning environment. The students were able to move their chairs easily and get together into small groups. The lecturer was able to move between groups fairly easily. After the small group discussion, the students came together and shouted out their answers to the entire class. The lecturer provided immediate feedback to the students after each part of the case study. The case study was followed by a formative assessment and data collection.

Chapter 7 Stage II Results and Discussion

This chapter presents the results from the second stage of this research. The first section of this chapter reports the findings from the quantitative analysis from the survey administered at the end of the traditional lecture and the flipped classroom sessions delivered as part of the quasi-experiment conducted in the school of pharmacy at both UOP and UCL. In addition, it summarises the findings from the quantitative analysis of the formative assessment delivered at the end of each teaching session. The second section presents the themes identified from the focus groups analysis. This chapter also provides a discussion of the main findings of this stage of the research.

7.1 Phase I: Quantitative Study on the Impact of the Flipped Classroom Teaching Method on MPharm Students

7.1.1 The survey response rate

About 95% of students at both the lecture and flipped classroom groups in UOP returned the survey and consented to take part in the study. At UCL, the rate was 100% for the lecture group, and approximately 84% for the flipped classroom group. See Table 7.1 below.

As Table 7.1 shows, 41 students returned the survey and agreed to participate in the UOP's lecture group, and 54 students in the flipped classroom group. For UCL, the sample size is 42 students for the lecture group, and 32 students for the flipped classroom group.

Table 7.1: The Survey Return Rate for University of Portsmouth and University College London

University		Condition	
		Traditional lecture	Flipped classroom
UOP	Number of attendees	43 students	57 students
	Number of returned surveys	41	54
	Survey return rate	95.35%	94.74%
UCL	Number of attendees	42 students	38 students
	Number of returned surveys	42	32
	Survey return rate	100%	84.21%

The frequencies command of the descriptive statistics in SPSS was used to detect the amount of missing/invalid data across the whole dataset. Missing/invalid data was identified in three variables of the survey: age, overall session rating and learning style. Refer to Table 7.2 for the summary of missed/invalid data in the surveys returned from UOP and UCL.

Table 7.2: Summary of Missed/Invalid Data in the Surveys Returned from University of Portsmouth and University College London

University	Variable name	Condition	
		Traditional lecture N (%)	Flipped classroom N (%)
UOP	Age	2 (4.88)	1 (1.85)
	Overall session rating	0 (0)	2 (3.7)
	Learning style	7 (17)	9 (16.67)
UCL	Overall session rating	0 (0)	2 (6.25)
	Learning style	9 (21.43)	8 (25)

7.1.2 Characteristics of Participants

With the exception of the UOP's flipped classroom group that had an equal number of male and female participants, just above 70% of the participants were female in all the groups. The majority of the participants in the four groups speak English as their first language. Figure 7.1 and Figure 7.2 show the first language of the non-native English-speaking participants at University of Portsmouth and University College London respectively. The average age of students was 22.47 years (*SD* = 1.81). See Table 7.3 for the demographic information for the survey participants at University of Portsmouth and University College London.

Table 7.3: Demographic Information for the Survey Participants at University of Portsmouth and University College London

University			Condition	
			Traditional lecture N (%)	Flipped classroom N (%)
UOP	Gender	Male	12 (29.3)	27 (50)
		Female	29 (70.7)	27 (50)
	Language	English	32 (78)	36 (66.7)
		Other	9 (22)	18 (33.3)
	Total (N)		41	54
	Mean Age (years)		22.59	22.81
	SD		1.65	2.78
	N		39	53
UCL	Gender	Male	12 (28.6)	8 (25)
		Female	30 (71.4)	24 (75)
	Language	English	27 (64.3)	20 (62.5)
		Other	15 (35.7)	12 (37.5)
	Total (N)		42	32
	Mean Age (years)		22.26	22.03
	SD		1.11	1.79
	N		42	32
Both Institutions				
	Mean Age (years)		22.47	
	SD		1.81	
	N		163	

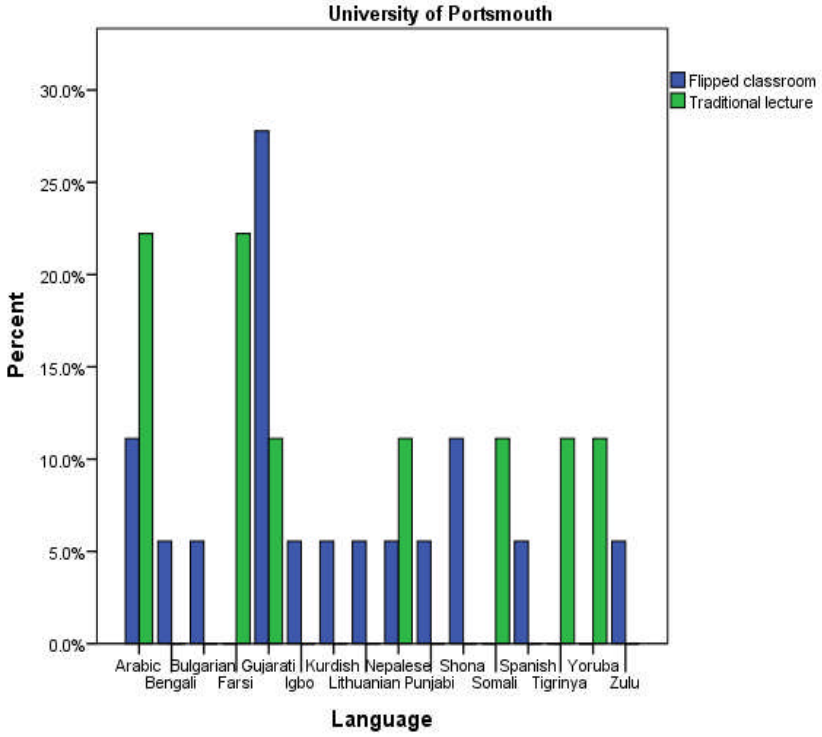

Figure 7.1: The First Language of the Non-Native English-Speaking Participants at University of Portsmouth

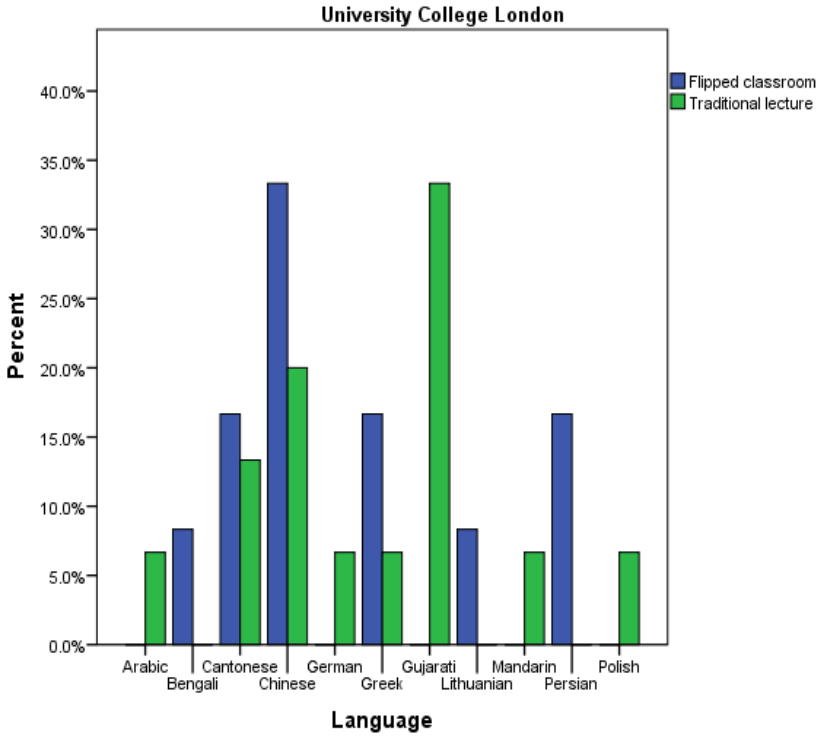

Figure 7.2: The First Language of the Non-Native English-Speaking Participants at University College London

One section of the survey requested the students to take the Kolb Learning Style Inventory test to determine their learning style (accommodating, diverging, converging or assimilating). At University of Portsmouth, 34 students completed the test in the traditional lecture group and 45 students in the flipped classroom group. At University College London, the test was completed by 33 students in the lecture group and 24 students in the flipped classroom group. The learning styles of the survey participants at UOP and UCL are shown in Figure 7.3 and Figure 7.4 respectively. In the traditional lecture group at UOP, the majority of students were assimilators and a small minority were accommodators. On the other hand, the flipped classroom group had almost equal numbers of divergers, convergers and assimilators. The rest of the group (just below 10%) were accommodators. At UCL, the traditional lecture group had a majority of assimilators and divergers. However, the majority of the participants in the flipped classroom group were divergers and convergers.

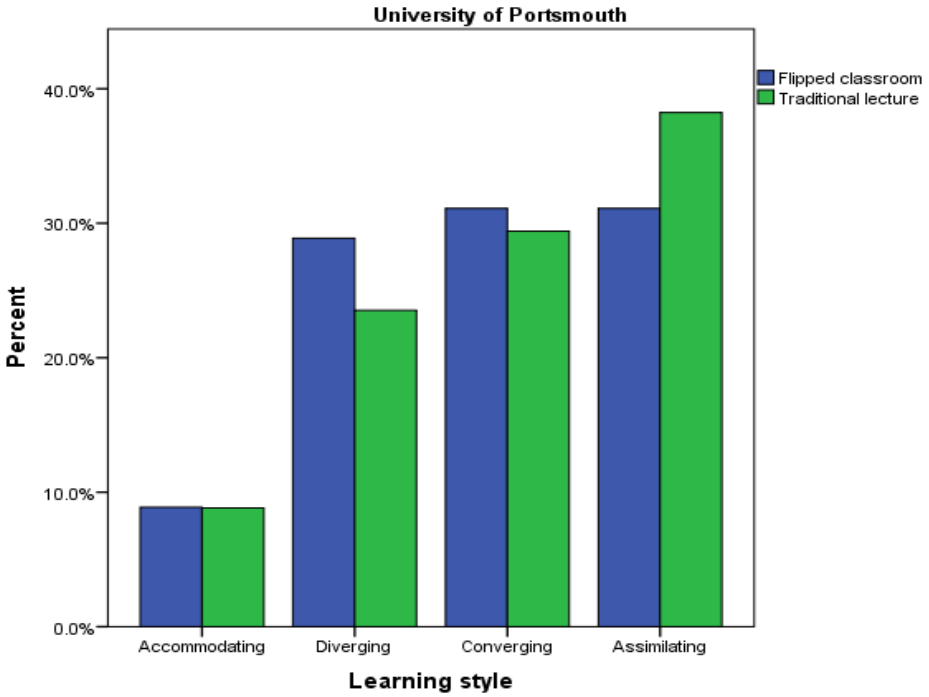

Figure 7.3: The Learning Style of Students at University of Portsmouth

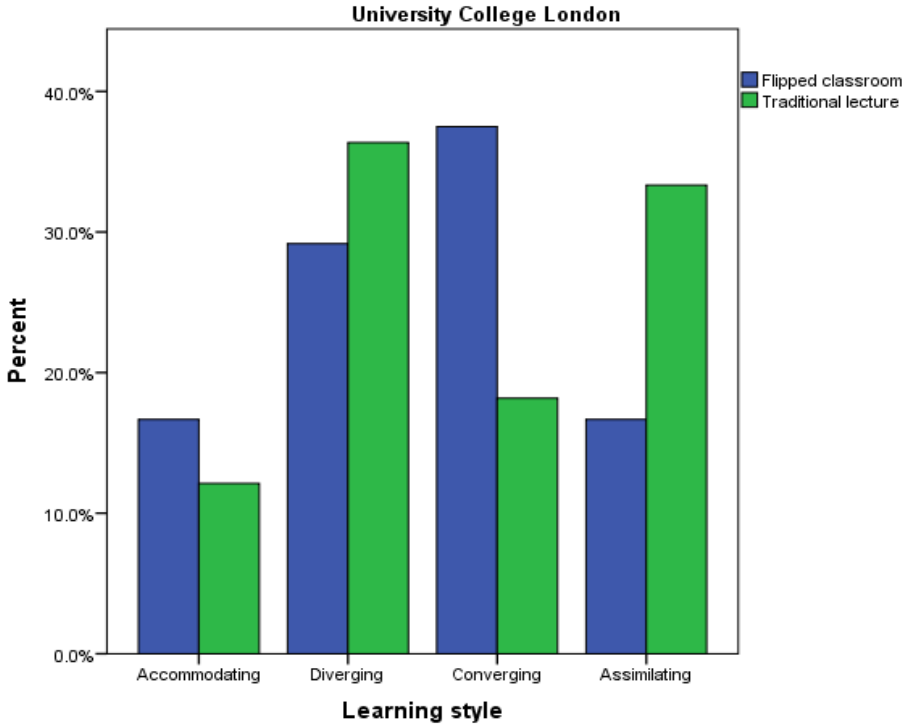

Figure 7.4: The Learning Style of Students at University College London

7.1.3 Engagement with the Pre-flipped Session Independent Learning

The students who attended the rheumatoid arthritis session in a flipped classroom format were asked to indicate whether or not they had completed any of the assigned pre-work: 81.5% of the students (N = 44) at University of Portsmouth and 71.7% of the students (N = 23) at UCL indicated that they had completed some of the assigned pre-work (see Figure 7.5).

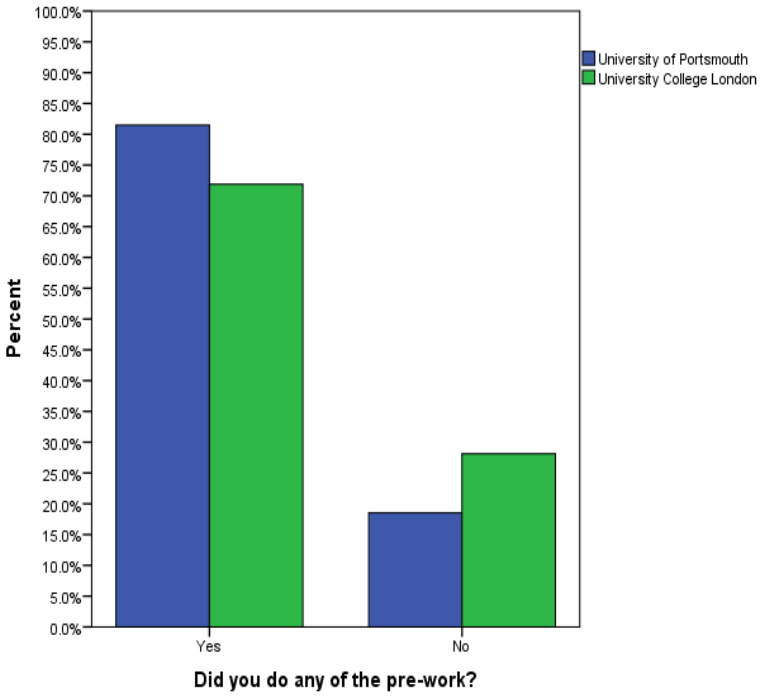

Figure 7.5: Engagement with the Pre-flipped Session Learning Material

The students were also asked in the survey to specify what assigned pre-lecture material they had completed. At both pharmacy institutions, the majority of students prepared for the flipped session by viewing the online lecture with or without attempting the post-video online quiz, and completing some reading (see Figure 7.6).

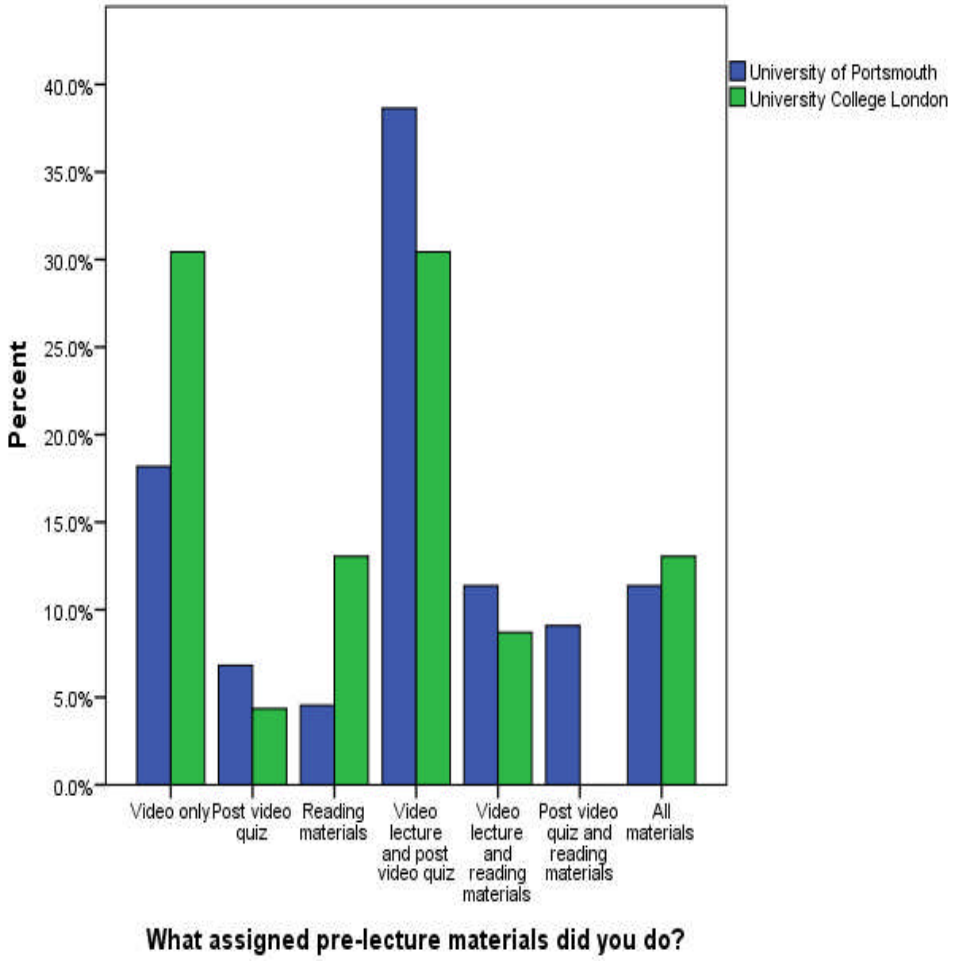

Figure 7.6: Engagement with the Different Pre-flipped Session Learning Materials

Another question asked the students to indicate how many days prior to the flipped session they had completed the pre-work. At University of Portsmouth, about 57% of the students stated that they had completed the assigned pre-work one day prior to the session. At UCL, however, nearly 48% completed the pre-work on the same day of the session, and about 30% did the pre-work one day before the scheduled session (refer to Figure 7.7).

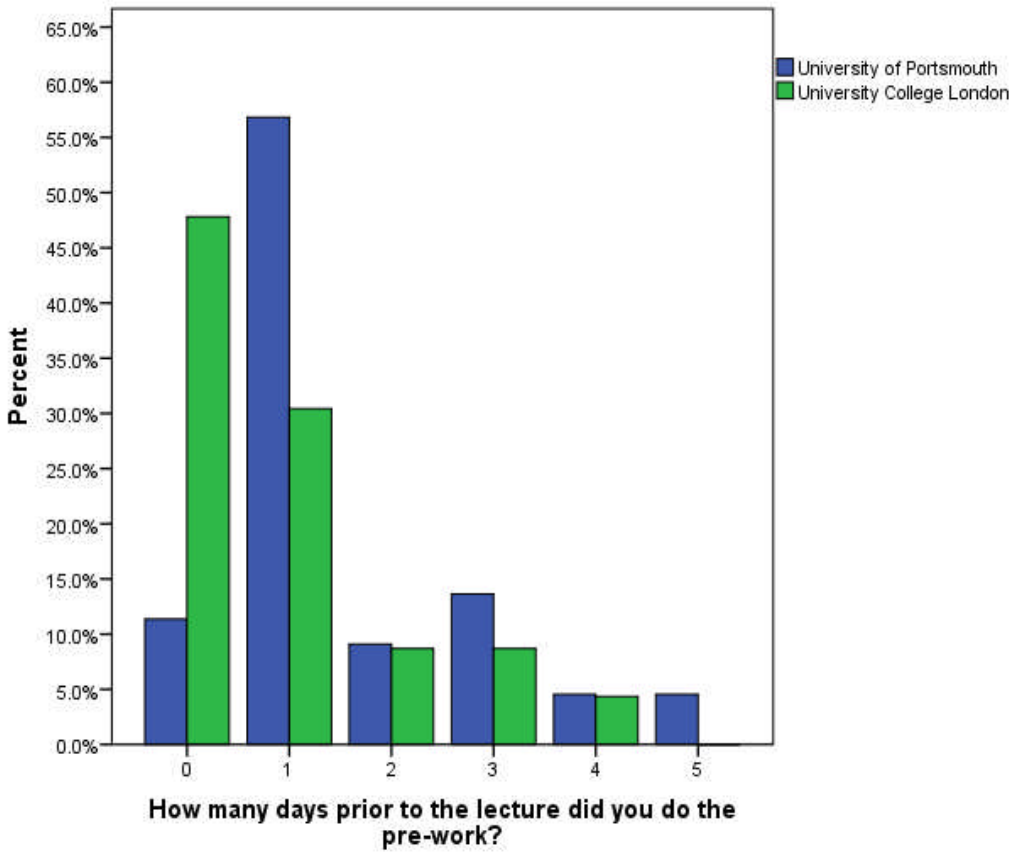

Figure 7.7: Number of Days Before the Flipped Session Students Completed the Assigned Learning

The participants were also asked in the survey to indicate how much time they spent doing the pre-work. For the UOP flipped classroom, the mean time spent on the pre-work was 78.89 minutes (N=44), SD = 45.16. At UCL, the mean time spent on the pre-work was 58.70 minutes (N=23), SD = 22 (see Figure 7.8).

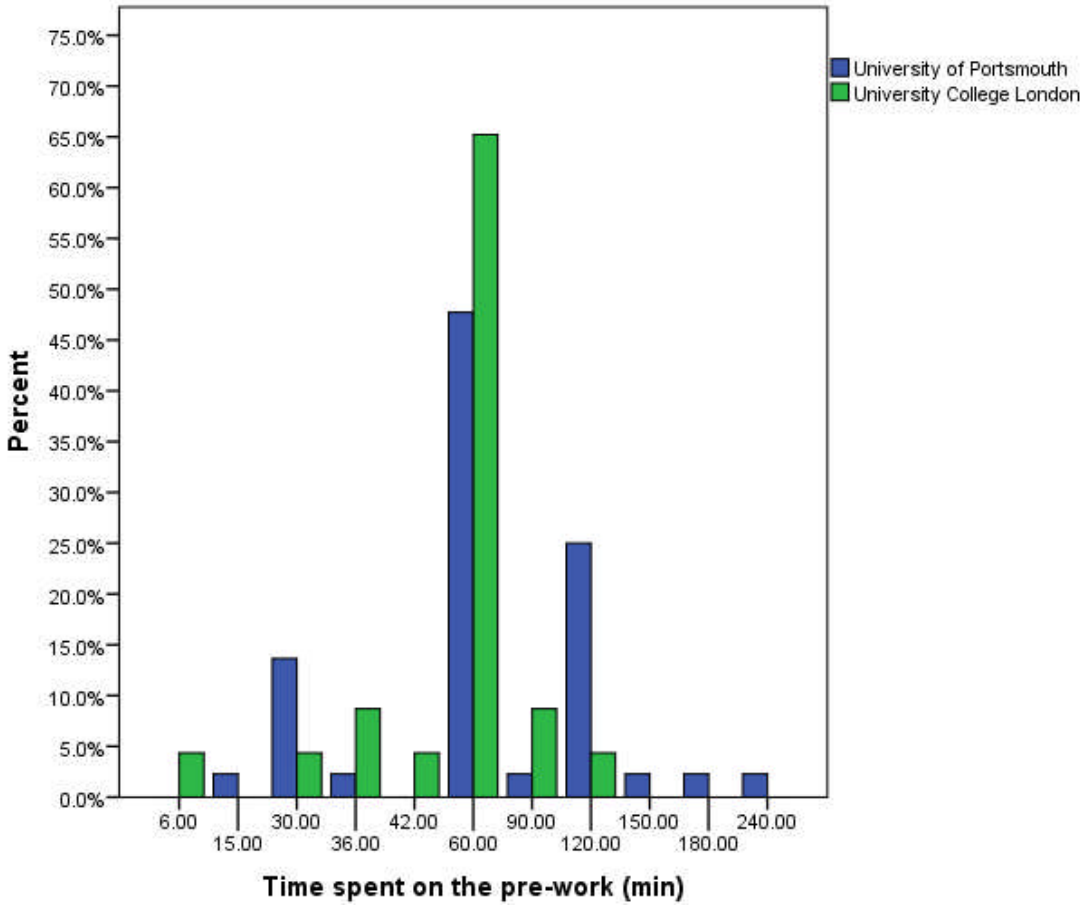

Figure 7.8: Time in Minutes Spent by Students on Completing the Pre-flipped Session Learning at University of Portsmouth and University College London

7.1.4 The College and University Classroom Environment Inventory

Table 7.4 below shows the comparison of the scales of the CUCEI for the traditional lecture group and the flipped classroom group at UOP and UCL using Mann-Whitney U test. At UOP, the rating of involvement, student cohesiveness, innovation and individualisation in the flipped classroom group was significantly higher than the traditional lecture group, $p<0.01$. However, there was no statistically significant difference between the two groups in the rating of the following domains: personalisation and satisfaction. At UCL, the rating of all domains of the CUCEI in the flipped classroom group was significantly higher than in the traditional lecture group, $p<0.05$. Thus, the survey findings suggested that the flipped classroom is superior to the traditional lecture with regard to the following aspects of the classroom environment: involvement, student cohesiveness, innovation and individualisation. However, the personalisation and satisfaction dimensions were improved in the flipped classroom at UCL. Conversely, these dimensions were enhanced in the flipped classroom at UOP, but not significantly. It is worth mentioning that far more class activities took place in the flipped classroom group than in the traditional lecture. Therefore, comparing the two groups is not ideal. Instead, looking at the median of the rating scale and comparing it with the average score seems more appropriate. As can be seen in Table 7.4, the median score for the traditional lecture and the flipped classroom groups at both pharmacy institutions is above the average score. This indicates that the class activities for both session formats were clear and well organised.

Table 7.4: Comparison of the Domains of the College and University Classroom Environment Inventory for the Traditional Lecture Format and the Flipped Classroom Format at University of Portsmouth and University College London Using Mann-Whitney U Test

Domain	Group		Median	Interquartile range	U	z	*P*
Personalisation	UOP	The traditional lecture	3.43	0.86	876.5	-1.74	0.082
		The flipped classroom	3.57	0.71			
	UCL	The traditional lecture	3.21	0.71	186.5	-5.311	**0.001**
		The flipped classroom	4.14	0.82			
Involvement	UOP	The traditional lecture	3.43	0.71	761.5	-2.609	**0.009**
		The flipped classroom	3.86	0.57			
	UCL	The traditional lecture	3.43	0.75	215.5	-5	**0.001**
		The flipped classroom	4.14	0.64			
Student cohesiveness	UOP	The traditional lecture	3.00	0.67	388.5	-5.429	**0.001**
		The flipped classroom	3.67	0.67			
	UCL	The traditional lecture	2.67	0.83	181	-5.371	**0.001**
		The flipped classroom	4.00	0.78			

Domain	Group		Median	Interquartile range	U	z	*P*
Satisfaction	UOP	The traditional lecture	4.14	0.43	919	-1.425	0.154
		The flipped classroom	4.29	0.71			
	UCL	The lecture	4	0.61	290	-4.196	**0.001**
		The flipped classroom	4.5	0.57			
Task orientation	UOP	The traditional lecture	3.57	0.43	1028	-0.6	0.548
		The flipped classroom	3.57	0.43			
	UCL	The traditional lecture	3.43	0.61	458	-2.359	**0.018**
		The flipped classroom	3.71	0.54			
Innovation	UOP	The traditional lecture	2.33	1	311.5	-6.014	**0.001**
		The flipped classroom	3.5	0.5			
	UCL	The traditional lecture	2.83	1.21	229.5	-4.846	**0.001**
		The flipped classroom	3.67	0.75			

Domain	Group		Median	Interquartile range	U	z	*P*
Individualisation	UOP	The traditional lecture	2.71	0.57	534.5	-4.336	**0.001**
		The flipped classroom	3	0.57			
	UCL	The traditional lecture	2.57	0.71	370	-3.310	**0.001**
		The flipped classroom	3	0.54			

7.1.5 The Overall Session Rating

The Mann-Whitney U test results in Table 7.5 below show that the overall session rating for the flipped classroom group in both pharmacy institutions was significantly higher than the traditional lecture group, *p=0.001.* Thus, the study indicated students' preference for the flipped classroom teaching approach over the traditional lecture.

Table 7.5: Comparison of the Overall Session Rating for the Lecture Format and the Flipped Classroom Format at University of Portsmouth and University of London Using Mann-Whitney U Test

Group		N	Median	Interquartile range	U	z	*P*
UOP	The traditional lecture	41	3	1	679	-3.175	**0.001**
	The flipped classroom	52	4	1			
UCL	The traditional lecture	42	4	1	363	-3.268	**0.001**
	The flipped classroom	30	4.5	1			

7.1.6 Association between Learning Style and Overall Session Rating

The Kruskal-Wallis H test results in Table 7.6 below show that there was no statistically significant difference in the overall session rating between the four learning styles categories: accommodating, diverging, converging and assimilating, within each group (the traditional lecture group, and the flipped classroom group) in both pharmacy institutions. Thus, the finding suggests that the learning style of students has no impact on their preference for the traditional lecture or the flipped classroom teaching approach, and based on aforementioned levels of satisfaction, the flipped classroom would benefit students who exhibit all learning styles.

Table 7.6: Comparison of the Overall Session Rating for the Four Categories of the Kolb Learning Styles in the Lecture and the Flipped Classroom Groups at University of Portsmouth and University College London Using Kruskal-Wallis H Test

Group		N	H	df	P
UOP	The traditional lecture	34	3.844	3	0.279
	The flipped classroom	44	0.480	3	0.923
UCL	The traditional lecture	33	1.767	3	0.622
	The flipped classroom	22	0.659	3	0.883

7.1.7 Association between Engagement with the Pre-Flipped Classroom Learning and Overall Session Rating

A Mann-Whitney U test was used to compare the overall session rating for the students who prepared for the flipped session and those who did not complete the assigned pre-flipped session learning in each pharmacy institution. As shown in Table 7.7 there was no statistically significant difference between the two categories of the flipped classroom group in each pharmacy school, *p=0.24* and *p=0.929* for UOP and UCL respectively. Thus, engagement with the pre-flipped session learning has no impact on students' views on the flipped classroom teaching approach.

Table 7.7: Comparison of the Overall Session Rating for the Students who Prepared and those who did not Prepare for the Flipped Session at University of Portsmouth and University College London Using Mann-Whitney U Test

The Flipped Classroom Group		N	Median	Interquartile range	U	z	*P*
UOP	Prepared for the flipped session	43	4	1	144	-1.286	0.24
	Did not prepare for the flipped session	9	4	2			
UCL	Prepared for the flipped session	21	5	1	92	-0.127	0.929
	Did not prepare for the flipped session	9	4	1			

7.1.8 The Formative Assessment

Table 7.8 shows a comparison of the formative assessment results for the traditional lecture group and the flipped classroom group at UOP and UCL using Chi-square test. With the exception of questions four, six and nine at UCL, there were no statistically significant differences in the results of all questions of the formative assessment between the two groups in each pharmacy school. Students in the flipped classroom group at UCL scored significantly higher than the traditional lecture group on the fourth, sixth and ninth questions of the formative assessment, $p<0.01$. A trend toward significance in favour of the flipped classroom was observed in the fourth question of UOP data (p=0.096). The findings indicated that the flipped classroom is comparable to or better than the traditional lecture with respect to knowledge acquisition.

Table 7.8: Comparison of the Formative Assessment Results for the Lecture Format and the Flipped Classroom Format Using Chi-Square Test

Question one						
Group		% correct answer	No of responses	No of correct answers	No of incorrect answers	Chi square test
UOP	The traditional lecture	61	23	14	9	X^2= 0.458, *df*= 1; *p*=0.498
	The flipped classroom	52	31	16	15	
UCL	The traditional lecture	71	42	30	12	X^2= 0.206, *df*= 1; *p*=0.650
	The flipped classroom	66	36	24	12	
Question two						
Group		% correct answer	No of responses	No of correct answers	No of incorrect answers	Chi square test
UOP	The traditional lecture	75	24	18	6	X^2= 2.226, *df*= 1; *p*=0.136
	The flipped classroom	56	34	19	15	
UCL	The traditional lecture	18	41	7	34	X^2= 1.438, *df*= 1; *p*=0.231
	The flipped classroom	28	35	10	25	

Question three						
Group		% correct answer	No of responses	No of correct answers	No of incorrect answers	Chi square test
UOP	The traditional lecture	63	24	15	9	X^2= 0.017, *df*= 1; *p*=0.895
	The flipped classroom	61	28	17	11	
UCL	The traditional lecture	43	40	17	23	X^2= 1.293, *df*= 1; *p*=0.256
	The flipped classroom	56	36	20	16	
Question four						
Group		% correct answer	No of responses	No of correct answers	No of incorrect answers	Chi square test
UOP	The traditional lecture	63	24	15	9	X^2= 2.773, *df*= 1; *p*=0.096
	The flipped classroom	83	29	24	5	
UCL	The traditional lecture	47	42	20	22	X^2= 9.480, *df*= 1; ***p*=0.002**
	The flipped classroom	81	37	30	7	
Question five						

Group		% correct answer	No of responses	No of correct answers	No of incorrect answers	Chi square test
UOP	The traditional lecture	88	24	21	3	X^2= 1.725, *df*= 1; *p*=0.189
	The flipped classroom	97	31	30	1	
UCL	The traditional lecture	79	42	33	9	X^2= 0.283, *df*= 1; *p*=0.595
	The flipped classroom	84	36	30	6	
Question six						
Group		% correct answer	No of responses	No of correct answers	No of incorrect answers	Chi square test
UOP	The traditional lecture	92	24	22	2	X^2= 0.390, *df*= 1; *p*=0.532
	The flipped classroom	86	29	25	4	
UCL	The traditional lecture	72	42	30	12	X^2= 6.973, *df*= 1; ***p*=0.008**
	The flipped classroom	94	36	34	2	
Question seven						

Group		% correct answer	No of responses	No of correct answers	No of incorrect answers	Chi square test
UOP	The traditional lecture	75	24	18	6	X^2= 1.965, *df*= 1; *p*=0.161
	The flipped classroom	57	30	17	13	
UCL	The traditional lecture	89	42	37	5	X^2= 0.751, *df*= 1; *p*=0.386
	The flipped classroom	81	37	30	7	
Question eight						
Group		% correct answer	No of responses	No of correct answers	No of incorrect answers	Chi square test
UOP	The traditional lecture	77	22	17	5	X^2= 1.197, *df*= 1; *p*=0.274
	The flipped classroom	89	27	24	3	
UCL	The traditional lecture	83	40	33	7	X^2= 0.026, *df*= 1; *p*=0.872
	The flipped classroom	81	37	30	7	

Question nine						
Group		% correct answer	No of responses	No of correct answers	No of incorrect answers	Chi square test
UOP	The traditional lecture	96	22	21	1	X^2= 1.299, *df*= 1; *p*=0.254
	The flipped classroom	100	28	28	0	
UCL	The traditional lecture	90	42	38	4	X^2= 3.712, *df*= 1; ***p*=0.05**
	The flipped classroom	100	37	37	0	
Question ten						
Group		% correct answer	No of responses	No of correct answers	No of incorrect answers	Chi square test
UOP	The traditional lecture	59	22	13	9	X^2= 0.014, *df*= 1; *p*=0.907
	The flipped classroom	61	28	17	11	
UCL	The traditional lecture	48	42	20	22	X^2= 0.326, *df*= 1; *p*=0.568
	The flipped classroom	54	37	20	17	

7.2 Phase II - Feasibility and acceptability of a flipped classroom

This section reports the themes identified from the analysis of two focus groups with year four MPharm participants (N=5 from UCL and N=4 from UOP) who attended a rheumatoid arthritis teaching session in a flipped classroom format. To ensure anonymity of the participants, real names have been replaced with pseudonyms. Refer to Table 7.9 for the focus groups' sample demographics. From the thematic analysis, the following overarching themes were revealed: *'Views on the pre-class independent learning'*; *'Preparation is key'*; *'In-class active learning'*; *'Learning scaffolding'*; *'The physical learning environment'*; *'Introducing the flipped classroom into the MPharm programme'*. A thematic map depicting each main theme and its associated sub-themes is given in Figure 7.9.

Table 7.9: Focus Groups' Sample Demographics

Pseudonym (P*)	Gender	Institution	Age
Anne (P12)	Female	School of Pharmacy and Biomedical Sciences, University of Portsmouth	22 years old
Dana (P13)	Female	UCL School of Pharmacy	21 years old
John (P14)	Male	School of Pharmacy and Biomedical Sciences, University of Portsmouth	22 years old
Lisa (P15)	Female	UCL School of Pharmacy	22 years old
Peter (P16)	Male	School of Pharmacy and Biomedical Sciences, University of Portsmouth	21 years old
Salma (P17)	Female	UCL School of Pharmacy	22 years old
Sam (P18)	Female	UCL School of Pharmacy	22 years old
Sonia (P19)	Female	UCL School of Pharmacy	22 years old
Zeina (P20)	Female	School of Pharmacy and Biomedical Sciences, University of Portsmouth	23 years old

* Participant number

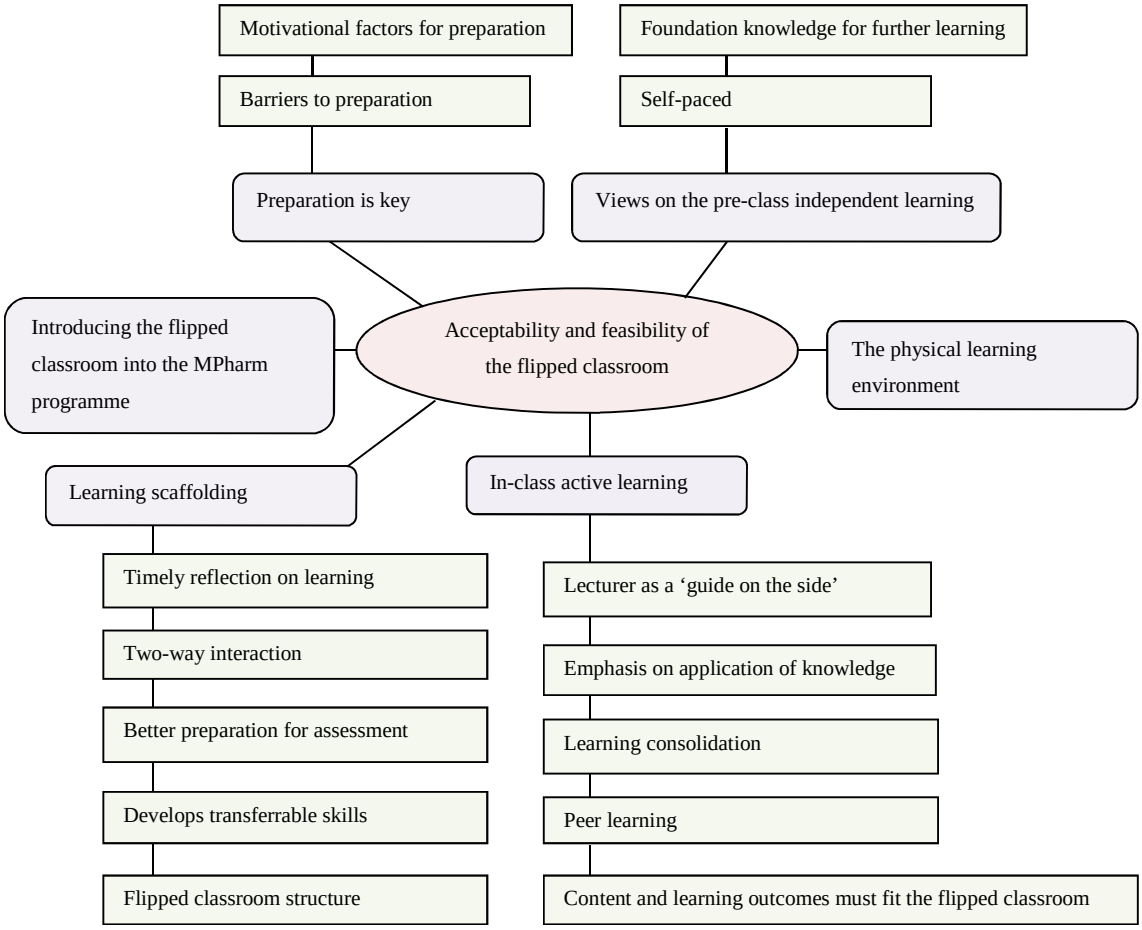

Figure 7.9: Thematic Map: Acceptability and Feasibility of the Flipped Classroom

7.2.1 Views of pre-class independent learning

This is an overarching theme that captures students' views of the pre-flipped session learning that they need to complete outside the contact time. *'Self-paced learning'* and *'Provides foundation for further learning'* are the two sub-themes identified from the focus group data.

7.2.1.1 Self-paced learning

'Self-paced learning' describes a positive feature related to independently learning the assigned topic through digital lecture recordings. The focus group participants seemed in favour of the recorded lecture over the traditional lecture as it gives a great deal of flexibility in terms of managing

the lecture learning and absorbing the information. In other words, students can pace the lecture according to their needs, which is difficult to achieve in traditional lectures.

> *"I thought it was good because you listen to the recording if you want back you didn't hear was in the lecture you can't do that"* [P17, UCL]

> *"You can go through it in your own time being able to pause the video means you can really take in what has been said whereas if you are in a lecture, you can't stop the lecturer, the lecturer will continue taking, but also if you don't hear something, in a lecture maybe you're more reluctant to put your hand up and ask the lecturer to recover it, where is you can just rewind the video"* [P16, UOP]

> *"I think yeah being able to go through it in your own time, and at your own pace and you can yes search things as well like they said stop the video and search a bit more about a particular drug or, I am not quite sure whether they mean or maybe rheumatoid arthritis what does a particular x-ray … you can go and search it, whereas in the lecture you might forget to do that as well"* [P12, UOP]

7.2.1.2 Provides foundation knowledge for further learning

This theme captures the benefits of gaining exposure to the material before the class. The participants emphasised that the pre-class learning gives a clear expectation of the face-to-face session and provides foundation knowledge. This in turn contributes to improving students' attention and academic gain, and also facilitates in-class active learning.

> *"I think it is more engaging, so it keeps me more interested and focused throughout the .. I suppose lecture as well as opposed to just being talked up"* [P12, UOP]

> *"Because we prepared beforehand it made me concentrate more in lesson or in the thing because I knew what was going on and I knew what the topic was about because I've done the work beforehand so I managed to do the work as well"* [P13, UCL]

> *"We came prepared and we already we had some ideas we thought off, so it seemed a lot more productive when working with*

people, it wasn't just sat there wondering what we were doing" [P12, UOP]

"You work together with somebody, you both got the same level of knowledge already erm as opposed to maybe somebody having more and the other having less, or vice versa so you know you are at the same level of knowledge so you can work better and get more out of the session" [P16, UOP]

The students made a link between the usefulness of the flipped classroom teaching method and the teaching style of the lecturer. They thought that this method of teaching could be a better alternative to the traditional lecture for those lecturers who are not good at engaging students in the traditional classroom. In addition, it might be a good alternative to the traditional lecture if the lecturer fails to pace the lecture in a way that considers both the subject's difficulty and students' needs.

"I think the effectiveness depends a lot on who the lecturers as well sometimes the lectures are really good and the lecturer is really good but other times it is more difficult to focus so then I think with some topics where is more difficult to focus is more to like too much to grasp then a flipped classroom method would be better" [P19, UCL]

"Especially like I would say maybe I would say one lecturer does not quite explain things fully in the lectures if we have the videos beforehand we can actually formulate questions which we can come with to the session actually say after watching the video, I have question for this part I can't quite understand, could you clarify? Because sometimes you can't follow up in the lecture, they get too quick or they just like brush over things without really fully explain, so I think not all but some" [P14, UOP]

7.2.2 Preparation is key

The theme *'Preparation is key'* captures one of the requisites for a successful flipped classroom. It was evident in the focus groups that engagement with the pre-class learning and students' self-motivation are fundamental for the success of the flipped classroom method of teaching. Failure to completing the assigned pre-class work was linked to losing the chance to engage with and benefit from the in-class active learning.

"I personally did not prepare for the lecture or the case-based discussion so I thought like I did not really benefit from it like If I had prepared I would have because I would know what to expect and I would just done the work and yes that's what I thought [LAUGH]" [P15, UCL]

"I agree with there been a lot more homework to do because then you actually sometimes what happens is even like I am taking from my experience because one of my options modules he does it [the flipped classroom] and then sometimes you think ok I will just go to the class and I won't do it because I don't have time I've got so much other work to do at home but then when I go to the class I don't know what he taking about" [P19, UCL]

"If you don't do the lecture before you go to the actual flipped classroom lecture then, the video online, then you won't understand the lecture really but you'll lose that part of your learning you won't, there is no other opportunity to cover that" [P16, UOP]

7.2.2.1 Barriers to pre-session learning

7.2.2.1.1 High workload

This theme captures one of the barriers that could potentially stop students from completing the independent learning portion of the flipped classroom. It was apparent in the focus group that participants were apprehensive about the potential increase in the workload associated with the independent learning required for the flipped active session. The students thought that flipping all traditional lectures might not be practical as an extremely heavy workload may be associated with the concurrent courses and this may lead them to skipping the pre-work. Thus, the students were not in favour of complete flipping of all conventional lectures as they would only complete the pre-work if time permits. The participants claimed that this flipped session worked well for them because there was not much coursework at the beginning of the term.

"If you had it we have like two lectures on Monday right normally if we did like first year we had so many lectures back to back if we do that for every single lecture then it is just gonna be too much and time consuming especially we have labs and other things like that so just not as frequent you can kind of said like once a week or something" [P17, UCL]

"Again, not all, some because as far as I was remembering back to first year we had one unit which we had about twenty odd lectures so if they all did videos before the lectures, I personally I would have never be able like to keep up with the material and if that was the only chance for me to learn I would definitely be behind with at least eleven lectures so I think again some, some is definitely better than all because it may become too much" [P14, UOP]

"For example if there is like one of us had one flipped lecture but if we had a lot I guess that could built up a lot of pre-work to do and if you also got coursework deadlines and other things you might not able to have time to do it so maybe a balance between the two" [P18, UCL]

"I think it worked well this time, but if all our lectures were like it, I can find that if we didn't have time to do the preparation beforehand then you would be really stuck which although is all your fault but now with fourth year and it is so busy it would be very difficult to put everything in" [P12, UOP]

7.2.2.1.2 Difficult/new concepts

'Difficult/new concepts' captures another potential barrier to the independent pre-flipped session learning. UCL School of Pharmacy's participants expressed concern over the potential use of the flipped classroom teaching method in delivering a new or a difficult concept. The students felt worried about the potential challenges associated with the independent learning paired with a lack of interaction with the lecturer.

"I think it will be quite stressful like say if you were to get a new disease and we have never learnt about it before we have to do this pre-work on it and then we have to come to the class and do more work on it can be quite daunting if you've never been exposed to that condition before" [P15, UCL]

"If you got taught cancer by this method and you got like some of the drugs as pre-work and you just don't understand straight away you might just give up, it is just too challenging" [P17, UCL]

"I also think just continuing with that so for example use the lecture recording and one fundamental thing you don't understand essentially the rest of the recording is a bit redundant because if you don't understand, you might not be able to understand the rest of it I know that does not happen often but I guess that could be a potential" [P18, UCL]

7.2.2.2 Motivational factors promoting pre-session learning

7.2.2.2.1 Having the right tools to prepare

This sub-theme captures the need to equip students with the right learning tools, considering quality and variety, in order to facilitate independent learning. It was evident in the focus groups that the quality of the recorded lecture has an impact on the success of the flipped session.

> *"I think also the quality of the recording make a big influence on it as well the one that we have for rheumatoid arthritis was a good recording so I think benefitted so I could imagine if the recording was a bit .. it's only as good as the information we are going to get, so I think that's going to be a big factor into it as well, so again it gonna be whether the lecturer willing to .."* [P18, UCL]

University of Portsmouth's participants expressed disappointment at not being able to access and annotate any online lecture notes, but only the recording that corresponded with the lecture slides.

> *"I am not sure if it was intentional or not, whether the rheumatoid arthritis lecture, there was no lecture notes online! There was just the video, and I found that for me I was having to write down everything you said because I felt was important, but where is you have lecture notes you can actually you write the extra stuff you were saying which are not on the slides"* [P14, UOP]

> *"Yeah, like kind of having slides so we can print out as well so we could annotate them"* [P12, UOP]

Despite having access to electronic lecture notes and references for further reading, UCL School of Pharmacy's participants suggested that physical, short notes related to the subject being covered should be provided. This would give them a great deal of flexibility in terms of how they wanted to learn the pre-session materials, as the internet is not accessible in all places.

> *"And even if you just have notes like short notes for someone to read because like in terms of internet access and stuff not everyone has erm internet, and obviously people have internet access at home but may not have time to watch it at home so they might watch it on their journey and they won't have internet access for example in the tubes so if you have notes so you can actually*

sit down on the tube and read it and use your time wisely" [P15, UCL]

"I said notes having notes in advance [Sam: yeah, so not just the lecture recording, also physical notes would be good as well]" [P17, UCL]

7.2.2.2.2 Rationalising the use of the flipped approach

This sub-theme captures the need to explain and rationalise the use of the flipped classroom approach as this could facilitate students' engagement with the learning. The students requested that the value behind using the flipped approach is explained to them. They claimed that seeing the relevance of using the flipped classroom format acted as a motivation for them to engage with the pre-session learning.

"I think also it depends what kind of the way you present that idea as well because I saw it as aww I basically being told to revise because I would need to go through the lecture anyway so if anything is just getting ahead of yourself so I think if you present it with the idea of essentially by the end of this week that's one lecture you will have not only learnt but revised so that definitely will ease the pressure for when it comes to exams so I think yeah it's about explaining the use of it. [It's about selling it]" [P18, UCL]

"I think it's also the way that you pitch it to students because they told us this isn't examinable so half of people bunked so you got to make sure that they understand that would benefit you it is like revising inside the lesson which will kind make sure there is lesson learning at the end but at the same time you don't have to understand again and again. It is just the way that you would tell it to students in first year" [P17, UCL]

"I think it would also motivate us if we saw the relevance of doing them so if we had them for every lecture it would be why this is happening just inefficient where as if we see the point of why we are doing it in that way so I think people are more likely to do it" [P12, UOP]

7.2.3 In-class active learning

This theme illustrates how the contact time was used in the flipped classroom method. Unlike the traditional lectures, the contact time in the flipped classroom is devoted to student engagement in active learning. After the

brief recap at the beginning of the flipped active session, the students were given case studies on a rheumatoid arthritis patient and were asked to work on them in small groups.

> *"We went through case studies so we came prepared and we already we had some ideas we thought off"* [P12, UOP]

> *"We went through case studies we had different sections to go through erm then we worked in small groups to then tackle it"* [P18, UCL]

7.2.3.1 Emphasis on application of knowledge

This sub-theme captures a positive key feature of the flipped classroom environment. It was evident in the focus groups that the flipped classroom teaching method places a greater emphasis on application of knowledge. Learning the knowledge-based content independently and using the class time for case-based learning allows students to apply their knowledge in real-life scenarios and go beyond recalling gained knowledge.

> *"I think the main thing is that we can see how the lecture is applied in a question setting I think and then actually being able to answer it because most of the time even when we see a question and even once you revised the lecture you still think ok I am not sure which part specifically framed to and how much depth I need to be going into and how I am actually going to tackle the question so this kind of addresses more applications I suppose to just the content"* [P18, UCL]

> *"It gives you the ability to apply your knowledge which is what the exam sorts of requires us to do it is just not simply recalling from the lecturers like have stated so this kind of prepares us for it in a way yeah"* [P13, UCL]

> *"I think the case study I think it was quite useful because it gives you an opportunity to apply your knowledge what you have learnt at the same time"* [P14, UOP]

7.2.3.2 Lecturer as a 'guide on the side'

This sub-theme captures the positive new facilitative role of the lecturer in the flipped session compared to the traditional role that takes place in the usual lectures. Focus group participants praised the role of the lecturer in the

flipped session. The students reported that, unlike focusing predominantly on delivering information, the lecturer's availability during the contact time offers students quality communication, and provides support and guidance.

> *"Also like that we can ask questions when she is next to us, where in the lectures we can't really ask questions if you are sitting right at the back, and then yeah It's good to ask questions"* [P17, UCL]

> *"There was a feedback session as well so like if there was something we had an issue with in the pre-work then we could have addressed it and [the lecturer] would have addressed it during the session just good yeah"* [P13, UCL]

> *"I think, also having a full case study, the case studies that we did having not only your peers but also a lecturer who is free to go through, it is kind of protected time where you have the lecturer to help you if you can't answer that question"* [P16, UOP]

> "*Yeah [the face-to-face time is really helpful], because they are not, the time that they're there with you in the lecture hall isn't to deliver material really because you already sort of know the material so they are just available to answer your questions which is very good"* [P16, UOP]

7.2.3.3 Learning consolidation

The sub-theme *'learning consolidation'* captures one of the benefits of the flipped active session. The participants expressed satisfaction with learning consolidation that takes place in the classroom. They claimed that applying what they have already learnt serves as revision and it might reduce their workload on them during the revision period.

> *"I think it was good about it is that you remembered what you taught because you go through it deeply then because I remembered what I was taught but like lectures I tend to forget it straight"* [P17, UCL]

> *"I think by learning it beforehand, going to the flipped classroom session, you are already revising what you have learnt and that helps to cement your learning and it because it is a different way of learning and your being asked to draw on your knowledge that you've learnt from the video before it helps you to form you know a clear memory of those things and then it is more familiar when you*

come to revise it later on in the year because you already looked at it at least twice" [P16, UOP]

7.2.3.4 Peer learning

This sub-theme was prevalent in the focus group data; it captures another benefit of the flipped active session. The participants pointed out that the flipped active session encourages peer learning through the small and large group discussions.

> *"At the end she went through the case studies as well I believe yeah I thought that was really beneficial instead of just leaving us hanging and finishing and going after we've done work because in case we miss something out or another group had something the other group didn't so we could've been filled in through that, so I thought that was good"* [P13, UCL]

> *"Sometimes you pick up things from people that you don't know I don't know if this is answering the question but like sometimes I am working in a group and someone says something and I am like aww I didn't know that like this because they've read something extra they just knew something extra and I think that's really important because sometimes like it can be really helpful so you pick up loads of things from other people"* [P19, UCL]

> *"You can see how other people answer the questions as well it's not just you on your own like Sonia was saying you might not know something that other people do know so it can help in that regard"* [P15, UCL]

> *"Sometimes I find people ask questions and I think that is really useful question, but I would never thought of asking that myself, so that's kind of helps you learning"* [P12, UOP]

> *"Doing it in a group as well helps you to you know unlock pieces of information you may not think about but somebody else brings about you know you might think of something and I might think of something different and you piece it together in that session"* [P14, UOP]

7.2.3.5 Content and learning outcomes must fit the flipped approach

The data suggested that there must be a fit between the flipped classroom teaching approach and the topic content and learning outcomes. Focus group participants asserted that the flipped classroom concept might be

applicable for pharmacy practice subjects that require application of knowledge, but it could be less beneficial for science-based subjects, e.g. pharmacology and chemistry.

> *"For example first year chemistry I thought that was fine the way it was taught so I wouldn't particularly need or want that one to be [flipped], however there were some stuff like may be cancer erm in third year erm that was difficult to kind of grasp and then yes I was just saying there was .. [more diseases], yeah diseases erm"* [P18, UCL]

> *"What about those lectures that we have this year so like the ones like public health and stuff say if you actually have questions you knew how to apply the knowledge rather than just lectures because I think topics that are really difficult to teach so sometimes when you have the questions it is easier to know what you need to be thinking about and how to answer them"* [P19, UCL]

> *"You have like lectures like calculations I think that would be ideal to do in such a setting because you can't have calculations in like a lecture format because you need to like apply and do the calculations yourself to know that you are understanding what they are teaching so I feel like it is good to have it more interactively"* [P13, UCL]

> *"The one that comes to mind is a practice unit so using it in practice unit more than in the science kind of unit that we have, because in the practice unit you can relate your teaching to specific patients' case studies and in what you will be doing in day to day basis as a pharmacist in hospital, community, and I guess yeah if you have it in the chemistry unit you could relate it to industry, but I think less useful for that sort of thing and more useful for people who will be patient facing a lot of the time because it really helps cement what the guidelines are saying, and like you know the way you should treat things, so I think that would really help in practice"* [P16, UOP]

> *"I think most of the time there is a place for both styles and it probably depends on what the lecturer is teaching and what they want us to know and take from it … so if it is just about how the GI system works and the pharmacology of drugs in it, it may be not necessarily so much use, whereas if we erm you know go back to case studies in pharmacy practice one asked to be able to think about what we know and how we would apply this in a case study,*

be a lot more practice based as well than I think lot more efficient that way" [P12, UOP]

7.2.4 Learning scaffolding

The chronology of the flipped classroom re-orders the typical traditional lecture learning management and allows for application of knowledge in a timely manner. Thus, it provides better management of learning. A common habit that typical students have is attending the traditional lecture and learning the materials later. To explain this further, typically students rely on the exam revision period for in-depth learning of traditional lecture materials. This practice is not efficient, for a number of reasons. First, students commonly have a high workload during the short exam revision period and a high number of materials waiting to be read. Second, the lack of face-to-face contact with the lecturer, which results in students failing to have their queries answered. Additionally, knowledge application takes place in isolation from peers and facilitator.

"I think I definitely I think is the mindset you have when you go into it because you will be thinking it is a lot of work but then its work that I don't have to do later then I think it kind of makes up for it I think it is the mindset that introduced it as because I saw it as aww erm because the work I am doing now is just means it will be easier when I come back to it later but I can imagine if it is for everything but then essentially you have to learn everything anyway so it's a case of just doing it a bit earlier so it just ease off the pressure, personally I think it is a really good idea" [P18, UCL]

"I think in a way when you have the video beforehand then you learn it then you come to lecture and you have case studies, or questions and stuff I think it is quite visual as a learning tool because you can then see how relevant this material is in addressing a certain situation or a certain case study and it shows how to answer questions as well because sometimes you learn like a block of lectures and it would probably come to you like towards consolidation period how that applies to a question or how can you use that to answer a question, but whereas if you learn it now and then apply it to a question or a case study, already you know how to place the information so you don't fall like behind a lot so as soon as you learn it you know how to apply it so it doesn't take you too long to you know learn it learn it learn it and then try to pick up how to apply this to a certain question or a certain case study or something like that" [P14, UOP]

7.2.4.1 Timely reflection on learning

This theme captures one of the benefits associated with learning in a flipped classroom environment, which typically involves two subsequent phases. It was apparent in the focus groups that the flipped active session paired with the immediate feedback allows students to reflect on their learning and identify gaps in their knowledge. In the traditional lecture, in comparison, students typically start reflecting on their learning during the exam revision period.

> *"I went home did the post work the quiz and I knew that unit quite well and I did well on it but lectures you don't get tested on it until you go back revise for exams and you've kind of forgotten about it"* [P17, UCL]

> *"At the end she went through the case studies as well I believe yeah I thought that was really beneficial instead of just leaving us hanging and finishing and going after we've done work because in case we miss something out or another group had something the other group didn't so we could've been filled in through that, so I thought that was good"* [P13, UCL]

> *"I think for me the .. being sort of learning it at home and then going into the lecture or room and having like a case study where you are tested .. not tested necessarily but you get the chance to test yourself on a knowledge erm, that what you get to kind of confirm what you are doing, also highlight things you don't know and things you didn't pick up from the lecture before"* [P16, UOP]

> *"When the answers are being reviewed it also highlights the gaps in you know the knowledge you had and what you think you had to know and sometimes it can come up to maybe you need to know a bit more about that so I think it was quite important and helped us apply and reflect on what we need to add on our knowledge as well"* [P14, UOP]

7.2.4.2 Two-way interaction

'Two-way interaction' is another sub-theme that reflects how the chronology of the flipped classroom impacts teacher-student interaction. The participants expressed appreciation for the flipped active session as it enables them to have their questions asked and answered before leaving the class. In the

traditional lecture, however, students frequently start to come up with questions when they revise for the exams.

> *"I think it was good because erm sometimes when you have erm previous knowledge then erm you can gain more from the class and you can ask questions about things that you don't understand and it also allows you to focus on certain points that you weren't that sure of before"* [P19, UCL]

> *"I think erm as it is intended it is quite interactive because it gives you a chance to formulate questions if you don't understand something, so sometimes let's say if you go to a traditional lecture when you come to the time when you revise that's when you start to come up with questions, but if you actually have the lecture beforehand and you have the video and you actually take notes down, then you can come to the lecture with them, questions to ask and then they could be solved and answered, so I think it is quite useful"* [P14, UOP]

7.2.4.3 Better preparation for assessment

This sub-theme captures how learning in a flipped classroom format compares with the traditional lecture in terms of preparing students for assessment. The participants reported that the flipped classroom teaching method could be better than the traditional lecture in preparing students for assessment. This is attributed to the deep understanding associated with knowledge application.

> *"It gives you the ability to apply your knowledge which is what the exam sorts of requires us to do it is just not simply recalling from the lecturers like have stated so this kind of prepares us for it in a way yeah"* [P13, UCL]

> *"I quite agree I think it is much better in terms of preparation for assessment because, I speak for myself, but when it comes to revising its I like to go through questions I like to rewrite questions and it's kind of familiar by the time you get to revising for you assessment or for your assessment you might get a question in the exam that says something similar to what you already seen and then that may trigger something which helps you to recall it without you know necessarily needing to refer to revision because it is already there"* [P16, UOP]

7.2.4.4 Develops transferrable skills

This sub-theme describes the perceived impact of the flipped classroom on the transferable skills that every pharmacist student should develop. Focus group participants pointed out that this method of teaching could be linked to improved professional skills such as teamwork, communication, problem solving, critical thinking and negotiation. This is mostly linked to the active learning that takes place during the session time, which typically involves students working on case studies in small groups.

> *"I think the one of the main things is the teamwork so collaborating and taking to other people that's of course regardless of where you are working you need to do that so communication skills"* [P18, UCL]

> *"I think it would help in areas where you have to improve your problem thinking so a lot of the practice ones as well because when you are working you have to think about problems and think of solutions and approaches and how you might manage patients conditions and treatments, so that is really good to hear other people's approaches and think about how you can improve your professional skills"* [P12, UOP]

> *"When it comes to the flipped classroom teaching style it's more practical because it is teaching problem-solving skills you know is teaching you teamwork, communications in small groups"* [P14, UOP]

> *"I think this is really valuable the critical thinking because I don't know for me I did a little bit of it when I went to school because I did eleven plus just critical thinking about the eleven plus but for others who don't have that then they might not got so much exposure to that in their school so obviously it is something really important to us as pharmacists to be able to decide what's right and wrong and compare things without you know taking a long time because you need to do it quite quickly so that's definitely important to have that experience"* [P16, UOP]

> *"I think it helps with some kind of negotiation as well between other people because you are sharing the ideas and sort of discussing what you are doing in these situations and it helps you make justifications for your points and hear others what have to say and you are doing that a lot in pharmacy practice listening to what other people have to say, yeah I think it helps"* [P12, UOP]

Additionally, the flipped classroom could help students to develop their own approach to solving problems, and therefore promotes autonomy in learning and boosts confidence. This is again attributed to the active learning phase of the flipped classroom.

> *"In terms of the pre-reg you don't really get like we do in some places you don't really most of the ways which you learn like pre-reg training and stuff is like in group work doing things in groups so I think it helps you prepare at least for like picking up things during pre-reg and even when you are working you not really gonna have lecturers and stuff to give you additional knowledge you just pick things up through like real-life situations so I guess you could kind of apply the case studies to real-life situations"* [P19, UCL]

> *"I think it was better because the other day we had a traditional lecture which was based more on case studies and doing patient, you got like optimisation really with that but because we have just been lectured I found that I was not really sure what I was taking from it, it was just their perspective and how they do it, whereas I think being much more interactive allowed you to think how would I actually do this and then you feel like you develop your own way of doing it, for then in practice and you feel more confident when you have to put it into practice and workshops"* [P12, UOP]

The participants claimed that this method of teaching that involves application of knowledge is superior to the traditional lecture in terms of preparing pharmacy students for the workplace. This is again due to knowledge application that takes place during the flipped active session.

> *"Again the whole application because being a pharmacist you need to apply your knowledge you can't just regurgitate and you actually know and another this is something I think I struggle with a little bit is erm knowing how to actually even when you know the knowledge how to say it to the patient so I think erm sometimes because you can't just say aww you have arrhythmia or something like that so you have to actually know how to address issues to the patient"* [P18, UCL]

> *"Because it's scenario based as well it gives us like a written form of something that could turn up whilst we are working so in a way I feel like that's good because it helps us prepare to what type of patients that may come through the door and then so it is written*

format but we can relate to it to real-life scenario so I feel like that was good" [P13, UCL]

"Better again because its already a practice-based scenario, erm with other lectures probably won't be delivered like that It will be delivered quite information heavy and it's for you to unpick that and for you to decide how that relates to your practice erm by relating it in a case study kind of thing in a flipped based classroom where you've learnt it and then you test yourself and erm the only way to really test yourself about those kind of things is to relate it to practice, I think better because you already have an understanding of what you want to do in those scenarios" [P16, UOP]

"With the normal type of teaching method whereby it's more theoretical like you are just learning material" [P14, UOP]

7.2.4.5 Flipped classroom structure

This theme captures students' views on the structure of the flipped classroom. In order to bridge the gap between the pre-class learning and the in-class learning activities, the flipped session started with five minutes' overview on the online rheumatoid arthritis lecture. The students were generally positive about the re-cap part of the session as it summarised the main points of the lecture, and it gave them the chance to reflect on their independent learning.

"I think we had recap very briefly on the video just to refresh everyone's memories" [P12, UOP]

"I think similar to that we had a recap, which was really useful erm because it highlights what you have learnt so you think oh yeah I did know that, I have learnt that" [P16, UOP]

One participant from UCL School of Pharmacy suggested displaying visual slides highlighting the key points of the lecture to refresh their memories.

"Maybe if at the beginning there is just like three or four slides just the main points on them or something just to refresh people's memory" [P19, UCL]

Another participant from University of Portsmouth expressed frustration with the length of the re-cap at the beginning of the session and she thought it was unnecessarily long.

> *"The lecture was a bit too long because we have already studied it, because obviously we did it beforehand so it should have been a bit more brief [moderator: you mean the recap?], yeah, it should have been a bit more brief"* [P20, UOP]

7.2.5 The physical learning environment

This theme captures students' views on the physical learning environment of the flipped active session. At University of Portsmouth, the active flipped session was run in a raked lecture theatre, and in a flat lecture theatre equipped with node chairs for UCL School of Pharmacy's students. The participants were divided in their views with respect to the appropriateness of the lecture theatre for running a flipped active session. Despite the unique design of UCL SOP's lecture theatre, which is intended for a quick transition between different teaching modes, the students felt that a regular classroom with round tables is better for facilitating group work.

> *"Maybe just in terms of the room setting it might have been better if there was like round tables or something because we had those chairs and then everyone just had to turn around and then it just became a bit difficult with some people, because I think you had just the seats with the tables I think maybe if we had proper tables or so you could all talk around it"* [P19, UCL]

> *"I think any group work is useful to have tables just so everybody could sit around and it's just more better for communication"* [P13, UCL]

The lecture theatre was generally accepted by University of Portsmouth's participants as it can accommodate a large number of students. However, one participant pointed out that the lecture theatre is not convenient for group work.

> *"I think it was ok but I think if you did it in a room more like this which is more like a classroom then you can work in bigger groups or work in groups easier because in those kinda groups you can*

only work with two people the people next to you or possibly some in front of you but it is a bit awkward trying to share desks or turning around and so may be in a classroom it might work a bit better than actual lecture theatre" [P16, UOP]

"I'd like to differ… I think we've been too picky, lecture room was fine [LAUGHTER], you can turn around fine any time" [P14, UOP]

"I see what Peter says, it is easier to get into groups as opposed to in a lecture theatre sometimes you come late and be sat by yourself then It's kind of you haven't got anyone to talk around, but with kind of small groups then we are finding we are having three different time schedules so then everyone's in and you could be all over the place with the timetable so trying to fit it in" [P12, UOP]

"Again, I'm sorry but I beg to differ, trying to fit the whole fourth year in a room is difficult, I think the lecture theatre is fine [LAUGHTER]" [P14, UOP]

"I prefer the lecture theatre" [P12, UOP]

"Yeah, it's fine, I like the lecture theatre" [P20, UOP]

7.2.6 Introducing the flipped classroom teaching method into the MPharm programme

Focus group participants supported the idea of introducing the concept of the flipped classroom in the early years of the MPharm programme, and ideally in the second year or towards the end of the first year. They believed that this would possibly give students some time to adjust to this method of teaching and develop basic professional skills.

"I think definitely in the first year because then it gives some time to get used to it as well also when you do something from the beginning then you are more likely to be successful at it because we never really have that you know in our previous years so it is just like it is just like class kind of thing and you don't really place that much importance to it" [P15, UCL]

"I also though if we have done it from the start you might not find that difficult to do because you are just in the mindset so you are like ok every week I should prepare for this one thing as opposed if I asked to now aww I need to go and work extra erm because I

think if I used to it I can't imagine it would have been that different" [P18, UCL]

"I think there might be some use for it in early years as well because I think introducing the way it is done it involves you really engaging in it and if you don't do the lecture before you go to the actual flipped classroom lecture then, the video online, then you won't understand the lecture really but you'll lose that part of your learning you won't, there is no other opportunity to cover that so by having it early on it teaches you to act professionally and to you know to manage your time correctly so you have the opportunity to do that learning so there is some use for it I think it teaches you in first year that uni is about independent learning when you get into fourth year so there might be some usefulness in it in first years as well" [P16, UOP]

"I personally think it should be started in second year not first year, because first year you, it is just like they just teach you lots of information but in second year you are actually putting it into practice so it is better to be taught then in practice again case studies" [P20, UOP]

7.3 Discussion

7.3.1 Engagement with the pre-flipped classroom learning

Findings from phase I of this study (section 7.1) indicated that the majority of students at both pharmacy institutions engaged with some of the assigned pre-flipped classroom learning (UOP= 81.5%, UCL=71.7%). The learning materials were posted for students on Moodle five days prior to the scheduled flipped active session. Thus, students could complete the session preparation at their own convenience. In addition, the learning materials were given to students in various formats including an online recorded lecture (corresponds with lecture slides), an online quiz, references to text-based readings, and a PDF file for the lecture slides (this was only available for the UCL group). Students' preparation for the flipped active session varied; however, the online lecture was the most popular format for preparation. This finding corroborates the results of Prescott et al. (2016), who suggested that online lectures are more attractive to students than text-based materials

when implementing the flipped classroom to teach a patient assessment course on a Doctor of Pharmacy programme.

Findings from phase II of this study (section 7.2) suggested that providing the right tools to students encourages independent learning and facilitates preparation for the active flipped session. The learning materials need to be provided to students in different formats including both recorded lectures and text-based reading materials. In addition, these learning tools need to be relevant to the planned in-class learning activities. The learning materials have to be made available to students in plenty of time with a subsequent reminder in order to enable them to complete the independent learning at their own convenience. Five days' notice was given to students in the implementation of the flipped classroom in this study, followed by a one-day reminder before the scheduled class time. The majority of students completed the pre-flipped classroom learning either a day prior to or on the same day as the scheduled class time. The current study did not aim to suggest how long in advance the pre-work should be assigned, nor did it aim to examine the appropriateness of allowing five days' notice with a subsequent reminder. In addition, this matter was not highlighted in previous research. Therefore, further research should be conducted to investigate this.

With respect to the time spent on the preparation, again it was variable among students but the mean time spent was 79 minutes for the UOP group and 59 minutes for the UCL group. One of the criticisms of the flipped classroom reported by students in the literature was the overwhelming workload required for the active session preparation. The authors emphasised that the pre-flipped session materials need to be of reasonable length (Khanova et al., 2015a; Koo et al., 2016; Tune et al., 2013; Wong et al., 2014). In the flipped classroom implementation in this study, the length of the online lecture was equivalent to what had been delivered in an hour-long traditional lecture.

7.3.2 Impact of the flipped classroom on the psychological learning environment

7.3.2.1 Personalisation

Measuring the personalisation aspect of the psychological environment of the classroom, in phase I of this study, showed that the flipped classroom teaching approach was superior to the traditional lecture in terms of offering opportunities for individual students to interact with the educator and in terms of considering their personal benefit. However, the difference was significant at UCL but not at UOP. This could be attributed to the class size and the physical environment of the classroom. Carpenter and colleagues (2015) argue that the physical structure of the classroom can have a huge impact on students' learning experience. The number of students who attended the flipped active session at UOP (57 students) was greater than UCL's group (38 students). With respect to the physical environment, the UOP's flipped active session was delivered in a traditional tiered lecture theatre. The observing researcher felt that the layout of the room was not facilitating the lecturer's movement around the students. Thus, the lecturer's engagement with monitoring students' progress with the learning activities was less than would be possible in a flat teaching space with ability to move around students. Conversely, the active flipped session at UCL was delivered in a flat lecture theatre that is equipped with chairs that have a swivel seat, a rotating table and a storage area. These chairs enabled students to get together into small groups and have a clear area around each group. The researcher felt that the layout of the classroom allowed the lecturer to move easily around the groups, monitor students' progress and assist those who needed help.

Superiority of the flipped classroom pedagogy in providing opportunities for personalisation was confirmed by the post-flipped classroom qualitative study, where students appreciated the facilitative role of the lecturer that took place during the contact time. The study reported that the availability of the lecturer during scheduled session time offered opportunities for guidance and

support in which students were able to ask questions and interact with the lecturer.

7.3.2.2 Involvement

When measuring active and attentive students' participation in the class, the current study indicated that the flipped classroom teaching approach was superior to the traditional lecture in involving students with the learning process. This finding supports those observed in phase II qualitative study, where students indicated that the flipped classroom pedagogy encourages active participation in the classroom. This was attributed to the two-phase structure of the flipped classroom approach, where students normally gain foundation knowledge before turning up to the scheduled session.

7.3.2.3 Student cohesiveness

Findings from the first phase of this study showed that the flipped classroom is better than the traditional lecture in terms of student cohesiveness. The qualitative study revealed that informal group work that takes place during the active learning exercises encourages social interaction and peer learning. This seems to be consistent with other research which found that the flipped classroom can make students feel more socially comfortable (Love et al., 2013). Knowles (1980) argues that learning that occurs in groups provides richer resources and motivation for learning. Learning activities that were designed for informal group work and took place in the flipped classroom implementation in the current study encouraged a collaborative atmosphere. The evidence shows that the collaborative atmosphere in learning groups, when compared to individual or competitive work, encourages more exchange of information, more helping and support among group members, creative thinking and more peer influence towards productivity (Wlodkowski, 1985).

7.3.2.4 Satisfaction

When measuring class enjoyment and satisfaction with what took place in the class, the current study showed that the difference in satisfaction rating was found significant only at UCL but not UOP, with the flipped classroom

showing a higher rating. Again, this could be attributed to the class size and the physical learning environment. The observing researcher felt that the traditional tiered lecture theatre was a barrier for students' engagement with the active learning. She felt that students sitting on the back rows were out of reach and they were not taking part in the large class discussions. In addition, the formation of small groups was limited to students sitting next to each other.

The findings from the post-flipped classroom focus groups indicated that the physical learning environment is a factor in students' satisfaction with the flipped active session. UOP's participants were divided in their views regarding the use of a traditional tiered lecture theatre for an active flipped session. The lecture theatre is good for accommodating a large number of students. However, some participants felt that it is a barrier for active learning since group membership was restricted to students sitting next to each other. Despite running the active session in a flat lecture theatre that has innovative chairs that allow for quick transition between the traditional and active learning modes, UCL's focus group participants felt that a regular classroom with chairs and round tables was preferable for group work. A possible explanation for this might be that the students at UCL are used to a particular physical classroom environment for group work.

7.3.2.5 Task Orientation

Results from phase I indicated that both the traditional lecture and flipped classroom teaching sessions were successful at orienting students towards the class activities. Contrary to this finding, Strayer (2012) reported that students in the flipped classroom found it difficult to connect pre-class learning and in-class learning. In addition, they felt less satisfied than those in the traditional lecture group with how the flipped classroom structure oriented them to the learning activities in the course. Similarly, Khanova et al. (2015b) documented a number of patterns of instructional misalignment when they examined multiple flipped courses in a PharmD curriculum. The following three distinct patterns of misalignment between pre-class and in-

class learning activities were noted in their paper: the excessive redundancy in the learning material for the pre-class and in-class phases, introducing completely new material during the class time; and a lack of learning activities to bridge the gap between the pre-class learning and the flipped active session. The authors of the study emphasised that the flipped classroom needs a thoughtful design with careful sequencing of learning activities. In the current flipped classroom implementation, basic knowledge about management of rheumatoid arthritis was provided to students to learn independently in both text-based and audio-visual formats. An online multiple choice quiz was created to reinforce student learning. The class time was spent on the following activities: a brief recap of the key points of the independent learning material, questions and answers about the pre-class learning, discussing case studies on a rheumatoid arthritis patient and finally a multiple choice formative assessment using TurningPoint technology. It is important to note that the students were given instructions on how to prepare for the contact time and what they need to know or have to do during the class time (Rotellar and Cain, 2016).

7.3.2.6 Innovation

Phase I data suggested that the flipped classroom teaching method enabled innovation in the learning environment when compared to the traditional lecture. This is most likely due to the fact that the contact time in the flipped classroom teaching approach is used for activities other than delivering the knowledge-based part of the subject. A study by Galway et al. (2014) documented that the variety of learning activities used in the contact time of the flipped classroom contributed to a positive student learning experience. Wlodkowski (1985) claims that variety has motivational effects as it stimulates and attracts the learner's attention towards its source. Thus, people commonly pay more attention to things that are changing than those that are monotonous (Wlodkowski, 1985).

7.3.2.7 Individualisation

Findings from phase I indicated that the flipped classroom teaching method encouraged individualisation in the learning environment when compared to the traditional lecture. This was confirmed in the phase II qualitative study where students felt that the flipped classroom provides opportunities for self-paced learning.

7.3.3 Impact of the flipped classroom on knowledge acquisition

Findings from phase I showed that the flipped classroom is comparable to or better than the traditional lecture with regard to knowledge acquisition. This was manifested by insignificant statistical differences in most of the formative test results between the flipped and the traditional lecture groups in both pharmacy institutions. The flipped classroom group at UCL scored significantly higher than the traditional lecture group in three questions out of 10. It is worth noting that the formative assessment was delivered at the end of each teaching session using TurningPoint technology. Unfortunately, around half of the students who attended the teaching sessions at UOP did not take part in the formative assessment as they had forgotten to bring their TurningPoint keypads into the session. This was different for UCL groups as Turning Point buttons are available for students to use by request from the e-learning coordinator. Thus, findings from the formative test at UOP do not reflect knowledge acquisition for all students who attended the rheumatoid arthritis session in both the traditional lecture and the flipped classroom formats.

Because the current flipped classroom study was conducted on a non-examinable topic, it was not possible to compare summative exam results between the traditional lecture group and the flipped classroom group. Instead, the current study examined student retention of knowledge, and it was found that the flipped classroom is comparable to or better than the traditional lecture with respect to knowledge acquisition. Findings from the literature suggested that the flipped classroom can have either no negative impact on summative exam results (Love et al., 2013; Muzyk et al., 2015) or

it could improve student examination performance (McLaughlin et al., 2013; Missildine et al., 2013; Moravec et al., 2010; Munson and Pierce, 2015; Pierce and Fox, 2012; Prescott et al., 2016; Tune et al., 2013).

7.3.4 Student preference for the flipped classroom teaching approach over the traditional lecture

The current study revealed compatible results with those reported in the literature, where students showed a stronger preference for the flipped classroom teaching format over the traditional lecture method (Cotta et al., 2016; Galway et al., 2014; Khanova et al., 2015b; Lage et al., 2000; Muzyk et al., 2015; Pierce and Fox, 2012; Tune et al., 2013). This was manifested by the overall rheumatoid arthritis session rating in the feedback responses for both the traditional lecture and the flipped classroom formats.

7.3.5 Learning style, preparation and teaching method preference

The students' learning style (diverging, assimilating, converging, or accommodating) was found to have no influence on their level of preference for the traditional lecture and the flipped classroom approaches. This particular finding indicates that the flipped classroom teaching method is preferred by and might be beneficial for all learning styles: divergers, assimilators, convergers, and accommodators. Likewise, engagement with the pre-flipped session independent learning did not influence students' views on the flipped classroom teaching approach. These are surprising findings since assimilators were expected to show a stronger preference for the traditional lecture (Table 1.4) than were the other styles of learners (divergers, convergers, and accommodators) (Kolb and Kolb, 2005a). In addition, those students who did not complete the independent learning were expected to show a lower level of satisfaction than those who did manage to prepare for the flipped active session, as preparing for the scheduled session was found in the current research to be critical for engaging with and benefiting from the active class learning. The reason behind this result might be the fact that the subject area in which the flipped classroom session was delivered was not a new concept, but rather a continuing professional

development session. In addition, the sessions were taught to the final year MPharm students, who are only a few steps away from professional practice. But perhaps, it could be hypothesised that even without pre-learning of some, the pre-learning of the majority still facilitated a more autonomous and satisfactory learning environment.

7.3.6 Student perspectives on the flipped classroom

The traditional lecture teaching approach normally fails to meet students' needs in terms of the fast pace of instructions (Biggs and Tang, 2011; Bligh, 2000; Brown, 1978; Buckridge and Guest, 2007). However, consistent with findings from previous research, this study indicated that the recorded lecture offers an opportunity for self-paced learning where students could benefit from going through the content at their own pace and as often as they need (Khanova et al., 2015b; Koo et al., 2016). Nonetheless, failing to complete the independent learning, which is the students' responsibility, could lead to students losing the chance to benefit from the in-class activities, as the pre-class phase provides foundation knowledge for further learning.

Providing students with the right learning tools for the pre-class phase considering both the quality and variability was found in the focus group data to motivate students to complete the independent learning. Another motivating factor highlighted was explaining to students the value of using the flipped classroom approach to replace traditional lectures. Khanova et al. (2015b), who examined students' experience of the flipped classroom in multiple courses in a single Doctor of Pharmacy curriculum, indicated that the quality of the online learning materials is a major factor in students' perceptions of the value of pre-class learning. Similarly, Wong and colleagues (2014), in their research on pharmacy students' performance and perceptions in a flipped teaching pilot on cardiac arrhythmias, found that students were concerned about the quality of the recorded lectures.

It is worth noting that the flipped classroom teaching sessions for the current study were delivered during the first few weeks of the new academic year

(third week at UOP, and fourth week at UCL). The students' workload during this period was probably lower than in later weeks and perhaps their enthusiasm was higher. Another point to consider is the topic on which the flipped classroom was delivered. In both pharmacy institutions, the subject was managing rheumatoid arthritis, which was not examinable, but students have come across the medications used in managing this condition. Thus, what has been delivered was regarded as a continuing professional development session. Findings from phase II of this study indicated that high workload and difficult or new concepts could be potential barriers to pre-flipped active session learning. This speculation was partly confirmed in Khanova and colleagues' (2015b) study. Their study found that the flipped classroom is associated with an increase in workload particularly in the presence of concurrent coursework, and the unmanageable workload was found to be a reason for students turning up to the flipped active session unprepared. Further work needs to be conducted to establish whether the flipped classroom teaching method is suitable for delivering new concepts or topics that are perceived by students as difficult to grasp.

In this research, students appreciated the learning scaffolding encouraged by the flipped classroom environment in which knowledge acquisition occurs outside the class time and a deeper approach to learning takes place during the contact time. In other words, students were positive about sequencing the complexity of the learning activities from lower-order to higher-order learning activities. The contact time was found to focus on application of knowledge using real-life scenarios where students work together in small, informal groups, and this was perceived positively by students. Additionally, students benefited from learning consolidation, peer learning and having the lecturer as a facilitator. These results mirror those observed in earlier studies in which students appreciated the knowledge application through in-class active learning, and the high amounts of interaction with other students and the educator (Galway et al., 2014; Khanova et al., 2015b; Love et al., 2013; Muzyk et al., 2015). Consistent with the findings of previous work, this study found that the flipped classroom could help students understand the taught

subject and prepare for summative assessment and future practice as a pharmacist (Camiel et al., 2016; Cotta et al., 2016). This is linked to the two-phase structure of the flipped classroom that encourages students to take control of their own learning and engage in class activities, which supports deep learning and skills development. However, in order to achieve the intended benefits of the flipped classroom, learning activities need to be carefully planned with sequencing the cognitive complexity of both pre-class and in-class learning. In addition, the flipped active session needs to be delivered in a classroom that facilitates active learning.

Another important finding reported in the current research was that there should be a fit between the flipped classroom approach and the topic content and learning outcomes. Students thought that the flipped classroom approach might be more beneficial for a topic that requires application of knowledge, such as pharmacy practice, and less beneficial for science-based subjects, for instance, chemistry. This can be explained by the fact that the independent learning phase could potentially increase students' workload. Failing to effectively use the contact time in a way that brings valuable advantages to students could potentially frustrate them. Consequently, this could discourage students from completing the class preparation and even attending the scheduled session. This finding is in agreement with Wong et al.'s (2014) research that looked at student perceptions of the flipped classroom implemented in three classes on cardiac arrhythmias (basic science, pharmacology and therapeutics). Findings from this research suggested that the flipped classroom teaching method need not be implemented across the entire curriculum. Student feedback indicated that the flipped classroom was perceived to be more effective for therapeutics than pharmacology due to the nature of in-class activities (discussion of patient cases in therapeutics, and discussion of calculations in pharmacology).

In order to allow for student adjustment to the flipped classroom teaching method, the students suggested using this instructional method from the

early years of the MPharm curriculum. Unlike the traditional lecture, the flipped classroom teaching approach requires students to utilise a range of transferable skills such as independent study skills, time management and team-working. Introducing this concept in the early years of the programme could potentially help students to build their capacity to succeed in this possibly unfamiliar learning environment.

7.4 Chapter summary

Findings from this phase indicated that knowledge acquisition in the flipped classroom was comparable to or superior to the traditional lecture when measured in the rheumatoid arthritis sessions using a formative test delivered through TurningPoint technology. The findings also showed that the flipped classroom teaching method was preferred over the traditional lecture format for delivering a CPD session on rheumatoid arthritis.

The students were particularly positive about the learning scaffolding associated with the flipped classroom, where knowledge acquisition occurs outside the class time and a deep approach to learning takes place during the flipped active session. The study suggested that the flipped classroom was superior to the traditional lecture with regard to the following dimensions of the psychological classroom environment: individualisation, innovation, student cohesiveness and involvement. In addition, the flipped classroom was successful in orienting students towards the class activities. However, satisfaction and personalisation dimensions could also be improved in the flipped classroom but this is conditional upon an appropriate physical learning environment and a manageable class size.

The recorded lecture was found to encourage self-paced learning where students could benefit from going through the content at their own pace and as often as they need to. However, failing to complete the pre-class learning can lead to losing the chance to benefit from the in-class active learning. Findings from this study also suggested that the flipped classroom approach

could help students understand the taught subject and prepare for summative assessment and future practice as a pharmacist.

The potential barriers and facilitating factors for the success of the flipped classroom implementation were also highlighted in this study. High workload on students, using the flipped classroom to deliver new or difficult concepts, and physical classroom environment that does not facilitate active learning environment were found among the potential barriers for a successful flipped classroom. However, providing the right learning tools for the pre-session phase, considering quality and variety, and rationalising the use of the flipped approach could facilitate students' engagement with the learning.

Students' learning style, whether it is diverging, assimilating, converging or accommodating, was found to have no influence on their perception of the flipped and traditional teaching approaches. In addition, introducing the flipped approach to the early years of the MPharm programme could assist in student adjustment to its unique requisites.

Chapter 8 Overall discussion

This chapter integrates findings from the both stages of this research and discusses them in the context of pharmacy education and adult literature. It also summarises the limitations of the research programme and highlights the implications of the study for practice and policy. In addition, it provides recommendations for future research.

Conducting this research was crucial since there is a paucity of published studies that explore the impact of the flipped classroom in higher education, particularly in pharmacy institutions. This research aimed to investigate the feasibility, acceptability and effectiveness of the flipped classroom teaching method for undergraduate pharmacy students in two pharmacy schools in the UK: UCL School of Pharmacy and the School of Pharmacy and Biomedical Sciences at Portsmouth University. The current PhD research was conducted in two stages. The first stage involved a qualitative study using a focus group approach that aimed to investigate the teaching and learning experiences of MPharm students, and to explore their views about the flipped classroom teaching method prior to a teaching session using this approach. The study (Chapter 4 and Chapter 5) was carried out during the academic year 2014/2015 in both UCL School of Pharmacy and the School of Pharmacy and Biomedical Sciences at University of Portsmouth. The second stage of this research involved conducting a quasi-experimental, mixed methods study in the academic year 2015/2016, in the same pharmacy institutions as in the earlier stage. This stage of the research was conducted in two consecutive phases. A comparative quantitative study looking at the impact of the flipped classroom on students' satisfaction and knowledge acquisition was conducted in the first phase, whereas the second phase involved a qualitative study to further explore students' satisfaction and attitudes towards the flipped classroom teaching model (Chapter 6 and Chapter 7).

In addition to the literature review results (Chapter 2), findings from stage I of this research informed the development of the intervention for stage II

research (section 6.2.3.2). Results from both stages of this research are integrated and discussed below. This will allow the fit of the data integration to be assessed, whether it is confirmation, expansion or discordance (Fetters et al., 2013). In addition, it will allow the implications for practice and policy to be discussed.

8.1 Key findings

8.1.1 Impact of the flipped classroom on knowledge acquisition

Results from this research indicated that knowledge acquisition in the flipped classroom was comparable to or superior to the traditional lecture when measured in the rheumatoid arthritis sessions using a formative test delivered through TurningPoint technology. The significant statistical difference in the formative test was reported in the UCL group, but not in the UOP one. It should be noted that in UOP, around half of the students who attended the teaching sessions did not take part in the formative assessment due to lack of access to TurningPoint keypads. Therefore, the findings from UOP are limited since they do not reflect knowledge acquisition for approximately half the students who attended the teaching sessions. This was attributed to the local regulations in UOP School of Pharmacy, where each student is given a TurningPoint keypad to keep throughout the MPharm programme so it could be brought to any teaching session. From this reflection, it would be advisable to reconsider how the TurningPoint keypads are managed in UOP. One possible solution is to keep these devices as school property and allow their use in any teaching space by request from the lecturer. This practice has been followed in UCL SOP and it seems successful since all students in UCL groups managed to obtain access to TurningPoint keypads and take part in the activity. Changing the practice in managing the keypads is essential since it could prevent students being excluded from the learning activity and, therefore, guarantee equal opportunities for participation.

8.1.2 Student satisfaction with and attitudes towards the flipped classroom

Findings from stage II showed that the flipped classroom teaching method was preferred over the traditional lecture format for delivering a CPD session on rheumatoid arthritis. This was demonstrated by the significant difference in the overall session rating in student feedback responses between the traditional lecture and the flipped classroom in both pharmacy schools. Consistent with the findings from stage I, the students were particularly positive about the learning scaffolding associated with the flipped classroom, where knowledge acquisition occurs outside the class time and a deep approach to learning that targets higher-order thinking skills takes place during the flipped active session. This could be elucidated by the core assumption of the adult learning theory, which suggests that adult learners generally have a preference towards a problem-solving orientation to learning, rather than subject-centred learning. In addition, adult learning is enhanced when new information is presented in a real-life context (Knowles et al., 2012). In the implementation of the flipped classroom in the current research, the structure of the flipped classroom session was probably successful in encouraging students to touch on all four stages of the Kolb's Experiential Learning Model (Figure 1.4). Students firstly were exposed to the first stage of the learning cycle, Concrete Experience, through engagement with the pre-class learning. The next learning mode, Reflective Observation, was possibly achieved through the online quiz and the question and answer stage at the beginning of the scheduled sessions. Students were probably moved to the Abstract Conceptualisation and then Active Experimentation stages through peer and facilitator's support in addition to working on case studies in a real-life context.

The study suggested that the flipped classroom was superior to the traditional lecture with regard to the following dimensions of the psychological classroom environment: individualisation, innovation, student cohesiveness and involvement. In addition, the flipped classroom was successful in orienting students towards the class activities. However, satisfaction and

personalisation dimensions could also be improved in the flipped classroom but this is conditional upon an appropriate physical learning environment and a manageable class size. These findings seem to be consistent with the stage I study which provided an expansion of understanding and found that the flipped classroom teaching approach could potentially serve as a positive tool to overcome the present challenges of the traditional lecture. In particular, this study reported that learning can be emotional and students could experience anxiety from engaging in a large classroom environment. Thus, it is likely that they will respond to this perceptively threatening environment by disengaging. In addition, the study reported a perceived need to engage students with the learning process in the traditional lecture classes, and to deliver the content at a pace that takes into account student needs and subject difficulty. The flipped classroom was found in this research to overcome the challenge of the traditional lecture since the distance between the student and the educator is normally lessened as the lecturer takes a facilitative role. Consequently, the two-way dialogue between the student and the educator is encouraged as the environment is seen as emotionally safe. Additionally, preparing for the contact time was found in the present research to reduce students' anxiety, foster their confidence, and thus promote class engagement. Pacing the instructions according to students' needs could be achieved through the flipped classroom teaching method where a recorded lecture is made available to students to view in their own time, and at their own pace.

The two-phase structure of the flipped classroom approach was found to encourage reflection on learning during the contact time. In addition, it allows for two-way interaction between the educator and students. In the traditional lecture approach, in comparison, students normally rely on the exam revision period to study the lecture materials for the first time, where reflection on learning occurs in isolation from the educator and peers. Additionally, a high workload during this period commonly forces students to adopt a surface approach to learning, which involves regurgitation instead of deep understanding (Biggs and Tang, 2011). Therefore, the learning scaffolding

associated with the flipped classroom teaching method is expected to advantage learners in a number of ways. Firstly, the learning consolidation and the deep understanding that is associated with knowledge application during the flipped active session could potentially be advantageous in preparing learners for assessment. Assessment methods used in MPharm programmes in the UK normally require students to master a range of higher-order cognitive skills and knowledge. For instance, in the OSCEs, pharmacy students are expected to be able to demonstrate that they can perform in a simulated environment (GPhC, 2011). Secondly, the flipped classroom teaching approach may possibly promote development of transferable skills that are necessary for the future pharmacist career. This is attributed to the fact that the flipped classroom encourages students to take control of their own learning and engage in active learning coupled with a small group discussion. Examples of these transferable skills include teamwork, communication, problem solving, critical thinking, negotiation, autonomy and work ethic.

It is important to note that the positive student experience towards the flipped classroom approach is not guaranteed in contexts that are different from the current study. To illustrate this further, assessment methods used in accredited MPharm programmes in the UK test the achievement of initial education of pharmacists' outcomes (Table 1.6) that range from recitation of facts to performance (Figure 1.8). Thus, pharmacy students in the UK, especially those in the final year of MPharm programmes, are likely to show a positive attitude towards the flipped classroom possibly due to their awareness of the value of this approach to their success. Conversely, in contexts where students do not face a challenge in assessment methods and are not aware of the value that this teaching approach might have for their success in a future career as a pharmacist, dissatisfaction and resistance are likely. However, students in early years of MPharm programmes might also meet the flipped classroom approach with resistance as their skills and competence in mastering this teaching method could be underdeveloped compared to those of senior students.

Students' learning style, whether it is diverging, assimilating, converging or accommodating, was found to have no influence on their perception of the flipped and traditional teaching approaches. This is important to note, as it highlights that there would be no disadvantage to a particular learning style should the flipped classroom be adopted.

8.1.3 Challenges in implementing the flipped classroom

Findings from the focus group data (both stages) indicate that engagement with pre-flipped classroom learning is fundamental to enable students to benefit from the active flipped session as it provides foundation knowledge for further learning. Unlike the traditional lecture, the flipped classroom teaching method requires students to take responsibility for their own learning by requiring them to complete independent learning before attending the scheduled session. In line with the flipped classroom concept and according to Bloom's taxonomy, the pre-class learning commonly requires lower-order cognitive skills involving remembering and understanding. Conversely, the learning activates that usually take place during the contact time require higher-order cognitive skills, for instance, applying, analysing and evaluating (Anderson and Krathwohl, 2001; Bloom, 1956). It is important to note that higher-level cognitive skills in the taxonomy integrate lower-level cognitive skills, for instance, mastering the two foundational cognitive skills, remembering and understanding, is necessary for a task that requires the next cognitive domain – application (Adams, 2015). High workload on students, using the flipped classroom to deliver new or difficult concepts, and physical classroom environment that does not facilitate active learning environment were found among the potential barriers for a successful flipped classroom. To explain this further, engaging with both the pre-class independent learning and the in-class learning, which are sequenced in terms of cognitive complexity, is necessary for achieving the intended learning outcomes. High workload on students or using the flipped classroom approach to teach a new or difficult concept were found to discourage students from engaging with the independent learning. However, delivering the active learning session in a traditional lecture theatre was found in this

research to be a barrier for student-student and student-teacher interaction, and thus a barrier to benefiting from the contact time.

8.1.4 Improving implementation of the flipped classroom teaching method

The current qualitative research found that there are several motivational factors that educators could take into consideration to motivate students to prepare for the flipped active session. In addition to ensuring the quality of the recorded lecture or the audio-visual material, the learning tools need to be offered to students in both text-based and audio-visual format to accommodate students' diversity and preferences. Another important motivational factor was rationalising the use of the flipped format and explaining to students the value of flipping traditional lectures. This particular motivational factor could be linked to the first assumption of Knowles' andragogy, which implies that adult learners need to be engaged in mutual planning for the learning process. This could be further explained by the principle that adult learners tend to give careful attention to the learning for which they are held accountable (Good, 1983; Wlodkowski, 1985), and they are motivated towards the learning that has a personal value to them (Knowles et al., 2012). Thus, students are more likely to take seriously the pre-class learning when the lecturer clearly explain to them that completing the self-study is important for progressing with the in-class activities. The lecturer might also explain to students that flipping the classroom is valuable in building not only the knowledge but also the skills that they will have to demonstrate in their assessment and their future career as a pharmacist. The final motivational factor that was highlighted in the current research is providing enough notice for students to complete the pre-work, with a subsequent reminder.

In order to achieve the learning scaffolding in a flipped classroom, the scheduled class time needs to be structured in a way that enables students to link the pre-class learning with the class activities, for instance, by starting the active flipped session with a brief recap that summarises the key points

of the online lecture and gives students an opportunity to ask questions or seek clarification. In addition, the physical learning environment needs to be taken into account when teaching in a flipped classroom format. Essentially, the flipped active session needs to be delivered in a classroom that facilitates the active learning environment. Thus, tiered and static lecture theatres should be avoided as they were found in this research to be a barrier to active learning.

Another important finding reported in the current research was that there should be a fit between the flipped classroom approach and the topic content and learning outcomes. Students thought that the flipped classroom approach might be more beneficial for a topic that requires application of knowledge, such as pharmacy practice, and less beneficial for science-based subjects, for instance, chemistry. This can be explained by the fact that the independent learning phase could potentially increase students' workload. Failing to effectively use the contact time in a way that brings valuable advantages to students could potentially frustrate them. Consequently, this could discourage students from completing the class preparation and even attending the scheduled session.

Findings from the current research indicate that, due to the unique requirements of the flipped classroom approach and in order to allow students to achieve its intended benefits, flipping traditional lectures needs to be carried out selectively across the curriculum. A possible explanation for this is that adult learners tend to be motivated towards the learning experiences that bring value to them (Knowles et al., 2012). Perceived value is defined as perceived assessment of the amount of benefit received, versus the cost paid to achieve these benefits (Zhai et al., 2017). Therefore, it is important to assess the risks versus the benefits before employing the flipped classroom pedagogy.

Because this innovative teaching method requires students to take charge of their own learning, the students suggested introducing the concept of flipped classroom in the early years of the MPharm programme. Thus, students

could have some time to adjust to this teaching method and develop the basic transferable skills. Based on the adult learning theory, a learner's prior experiences are critical in shaping their learning. Adult learners have a natural tendency to resist new learning that challenges existing mental schema from their prior experience. Overcoming this tendency requires changing the existing mental model in order to fit the current situation, which is not straightforward for most adults (Knowles et al., 2012). Wlodkowski (1985) argues that having some elements of challenge in the learning environment serves as an excellent opportunity for adult learners to affirm themselves and to build competence and confidence. However, educator support is very important in the learning environments that create challenge to learners (Wlodkowski, 1985). Therefore, introducing the flipped classroom teaching method in the early years of the MPharm programme might be met with resistance initially, as students probably have poor competence in mastering this method of teaching that requires a range of transferable skills such as independent study skills, time management and team-working. Their skills and competence could develop gradually and subsequently their expectations about the flipped classroom might change in the later years of the MPharm programme as a result of their prior experience with this learning environment, which would no longer be new to them. This could also apply to contexts where delivering the curriculum is heavily dependent on the traditional lecture.

8.2 Research contribution to undergraduate pharmacy education in the UK

QQA in the UK asserts that MPharm graduates are expected to demonstrate a range of pharmacy-related cognitive and practical skills and a range of transferable skills, such as self-study skills that are necessary for the continuing professional development for pharmacists (QAA, 2002). The findings from this research make several contributions to the current literature. First, its mixed-methods design enabled us to gain in-depth knowledge of MPharm students' perceptions and experiences towards the flipped classroom teaching pedagogy. Second, this research proposes

evidence-based recommendations that might inform a successful application of the flipped classroom. Findings from this research provide valuable data indicating that using flipped classroom pedagogy to deliver a pharmacy practice topic was associated with a positive learning experience. An implication of this is the possibility that implementing the flipped classroom in MPharm programmes considering the recommendations proposed in the current research could potentially improve National Student Survey (NSS) results relating to teaching on the course. Therefore, improving the Teaching Excellence Framework (TEF) performance for the institution, which is heavily dependent on NSS data.

8.3 Implications for practice and policy

In light of the variability in educational environments, evaluating educational methods is complicated. Thus, educators should keep in mind that the success of implementing the flipped classroom depends primarily on appropriate instructional design (Rotellar and Cain, 2016). Careful consideration needs to be adopted when implementing the flipped classroom model in undergraduate pharmacy curricula. Using this approach to completely replace the traditional lecture-based method of teaching is not proper for a number of reasons. First, implementing the flipped classroom could lead to excessive workloads for both teacher and students. Specifically, students are required to complete preparatory work independently before tuning up to the contact time. Likewise, teaching staff are expected to create learning activities for both the pre-class and in-class portions of the flipped classroom. Second, when compared to the traditional lecture, the flipped model is more expensive as it might require additional human resources and infrastructure. These may include IT support to assist in creating the pre-class learning, professional development activities on teaching and learning to support teaching staff in understanding the key concepts and designing appropriate learning activities, and equipment and editing software for lecture recording.

Therefore, it is important to achieve a balance when implementing the flipped classroom, considering the benefits it would bring to students in terms of improving their satisfaction and attaining the programme outcomes, the cost and resources needed, and also the workload on both students and teaching staff. Perhaps the flipped classroom approach could be implemented selectively in the curriculum to replace traditional lectures that are not complemented by tutorials or active learning sessions. This approach could also be gradually introduced in the early years of the MPharm programmes to assist in skills development. However, the complexity of the flipped classroom design needs to fit with the students' level of experience with both the content and the non-traditional teaching strategies.

Since implementing the flipped classroom might introduce changes in what is considered the norm for not only students but also teaching staff, resistance from both is likely. Resistance to change and innovation in higher education could be a consequence of developing a habit towards a current practice. In addition, it might occur as a result of the perceived risk associated with redefining traditional roles of students and academic staff (Bovill et al., 2016). Staff concerns may revolve around the potential increase in their workloads associated with creating learning activities for both pre-class and in-class portions of the flipped classroom. Academic staff might further be confronted by the challenge of choosing suitable learning activates for the contact time, which most likely involves running and managing a lecture-size class. Students, on the other hand, might meet the flipped classroom approach with resistance due to the new responsibility that mandates them to step out of their traditional role, which is often comfortable and involves passive learning.

Given these circumstances, offering teaching staff educational development opportunities may assist in easing their resistance towards the flipped classroom model. These opportunities might involve introducing basic concepts of teaching and learning in higher education, introducing active learning strategies and demonstrating a flipped classroom. Students might

benefit from understanding the value of learning through the flipped classroom approach. Thus, teacher support is important particularly in contexts where active learning is not an existing practice or where students' skills in mastering the flipped approach are low. Perhaps it might be beneficial to start small when implementing the flipped classroom to facilitate the transition for not only students but also academic staff. Bovill and colleagues (2016) claim that overcoming student resistance to a potential change can be achieved by actively listening and responding to their concerns. Based on the findings from the current research, the following recommendations might be valuable for effective flipped classroom implementation:

- Provide sufficient time for students to complete the pre-class independent learning, and ensure that they are reminded about the assigned pre-work.
- Provide students with guidance on pre-class preparation so they are clear about what they need to know or have to do during the scheduled session time.
- Provide the learning materials to students in various formats including recorded lectures, text-based reading materials and lecture notes. Ensure that the reading materials are provided to students in a printable format. In addition, recoded lectures need to be of high quality. On top of that, learning materials need to be easily accessible by students.
- Provide students with a reasonable amount of off-loaded content.
- Explain to students the value of flipping the traditional lectures, and enable them to see the value themselves by planning in-class learning activities that target higher-order thinking.
- The flipped active session needs to be delivered in a classroom that facilitates active learning. Avoid the traditional tiered lecture theatre as it was found to be a barrier for student-student and student-teacher interaction.
- Perform a facilitative role: move around the groups and monitor both individual and group work.

- Plan in-class learning activities that fit with the class size and available session time. In addition, make sure that the designed activities allow for group work.
- Ensure that there is a fit between the flipped approach and the topic content and learning outcomes.
- Integrate all pre-class and in-class activities, and explain to students that they need to complete both phases to achieve the intended learning outcomes.
- Provide an opportunity for students to re-inforce their learning and to assess their understanding of the off-loaded content. For instance, create a formative online quiz.
- Provide opportunities during the contact time for students ask questions and clarify concepts from the off-loaded content.
- Provide a brief recap or a very short summary about the off-loaded content, but do not reteach content again to help those who do not complete the preparation. This allows students to understand the importance of being accountable and taking control of their own learning.
- Ensure that the learning activities are sequenced in terms of cognitive complexity. In other words, plan learning activities that require lower-order thinking for the off-loaded content and activities that require higher-order thinking for the class time.

8.3.1 Flipped classroom and pharmacy education in Saudi Arabia

The current research programme was funded by the Saudi Ministry of Higher Education. In addition, Saudi Arabia is the country of origin of the principal researcher. Thus, discussing how this PhD research could be taken forward is valuable. This section provides a brief overview of pharmacy education in Saudi Arabia. It then goes on to discuss the implications of this research in the Saudi Arabian context.

Until 2000, the College of Pharmacy at King Saud University was the only pharmacy school in the country (KAU, 2012; KFU, 2013; KKU, 2012; MOHE, 2013). In a response to the increased demand for healthcare and higher

education, the number of Saudi colleges and universities has been increased from just eight to about 48 in no more than two decades (Sayed and Al-Shehri, 2012). Thus, pharmacy education infrastructure grew from one to 25 in less than two decades (MOHE, 2013). Saudi universities offer two principal degrees for both genders, who are taught separately, to enter the pharmacy profession namely: Bachelor of Pharmaceutical Science (B.Sc. Pharm) and Doctor of Pharmacy (PharmD) (MOHE, 2013). English is the language of instruction and assessment in all pharmacy schools in Saudi Arabia. The curriculum is predominantly delivered through traditional didactic lectures. Lectures are supplemented by diverse multimedia teaching methods such as slide shows and video clips. Students' learning and performance is assessed by written and oral examinations. Other means of assessment include presentations and short reports (Al-Wazaify et al., 2006).

Aljadhey and colleagues (2017) conducted a qualitative study to explore the views of pharmacy education stakeholders concerning the existing issues challenging pharmacy education in Saudi Arabia. The study findings suggested that there is a need to introduce new teaching methods that focus on self-directed learning and that have the potential to improve interaction between students and educators (Aljadhey et al., 2017). The flipped classroom pedagogy might offer valuable benefits for future developments of teaching and learning methods in Saudi pharmacy institutions. Unfortunately, Saudi pharmacy students might be relatively inexperienced in mastering active learning methods, since delivering the content of the curriculum is heavily dependent on the traditional lecture method. In addition, their self-study skills might be low. Based on these assumptions, students are likely to face unbearable challenges in tackling this new teaching method and its unfamiliar requisites. Therefore, it is extremely important that the educator aims to support students in building their skills and competence in order for them to be successful in learning through the flipped classroom teaching method. Additionally, it would be recommended that the flipped classroom teaching method is introduced in the early years of the academic programmes because doing so might have a positive effect on students'

expectations in the later years due to the skills developed through experiencing this learning approach at an early stage. Another benefit is that the flipped approach would allow for more standardised content to be delivered to both genders since education in Saudi Arabia is gender segregated.

8.4 Reflexivity

As discussed in section 3.2, qualitative researchers are not neutral, nor is the qualitative inquiry (Cohen et al., 2011). Thus, there is a positive value attached to subjectivity in the qualitative paradigm (Braun and Clarke, 2013), as researchers bring their own values, biases and perspectives into the research (Braun and Clarke, 2013; Cohen et al., 2011). Subjectivity can be reflected in what topics researchers find interesting to investigate, how they ask questions about them, and what aspects of data are found exciting (Braun and Clarke, 2013).

Reflexivity entails the researcher acknowledges and discloses their own self in the research (Cohen et al., 2011), by critically reflecting on the knowledge constructed and their role in producing that knowledge (Braun and Clarke, 2013). Braun and Clarke (2013) make a distinction between two types of reflexivity – functional and personal. Functional reflexivity is concerned with critically reflecting on how the research tools and process might have impacted the research. Personal reflexivity, however, involves bringing the researcher into the research by being visible as part of the research process.

In the current research project, and in an attempt to adhere to the reflexivity requirements, I disclose my personal and professional background in the preface at the beginning of this thesis (Page 18), to explain why I have particularly chosen this topic to research. I also acknowledge that, as I have been involved in every step of the qualitative research process, I may have had an influence on the knowledge produced. It is important to note that this is my first experience of engaging with research that employs a qualitative approach. Therefore, in addition to reading practical guides, I attended a

number of hands-on training workshops on the qualitative research method including conducting focus groups and analysing qualitative data. These opportunities allowed me to gain core knowledge on qualitative research and also practise my moderating skills for focus group discussions.

Reflecting on the researcher-researched relationship in qualitative research is imperative since it has an impact on the knowledge that is co-created between them (Hayfield and Huxley, 2015). Mercer (2007) argues that, in qualitative research, there is an insider/outsider continuum with multiple dimensions, and all researchers move back and forth along the continuum depending on the time, location, participants and topic. An insider researcher is one who shares the study participants' characteristics, role, or experience under the study (Dwyer and Buckle, 2009; Hayfield and Huxley, 2015). In the qualitative component of this research, I would consider my position as both insider and outsider (Dwyer and Buckle, 2009).

I felt that occupying two distinct positions throughout the research process, particularly during recruiting participants for the focus groups and conducting the discussions, was directly related to the amount and clarity of information about myself that was communicated to the potential participants. To explain this further, during the recruitment stage, I felt that I was perceived by the students as someone who is not familiar to them or who is an 'outsider', and this could have triggered the resistance to taking part in the study that was displayed by the majority.

However, introducing myself and having some informal chats before each focus group session encouraged trust, comfort and openness. Perhaps disclosing that I am a PhD student and I am also a pharmacist created some commonalties with focus group participants, and moved me closer to the 'insider' status. This was reflected in the transition of the participants' emotions from uncertainty when turning up to the discussion to appreciation and comfort at the end of it.

With respect to the context of this research, it falls into two disciplines, 'pharmacy' and 'education'. Reflecting on my background, I was a registered pharmacist in my home country, Saudi Arabia, and I had been exposed to a range of pharmacy services through training experiences. I was also engaged in the MSc in Clinical Pharmacy, International Practice and Policy at UCL and I also had a hospital placement experience at Kings College Hospital in London. These experiences have contributed positively to my understanding of part of the context I am researching, which is 'pharmacy'. However, I have never taken an academic position in higher education, although I have engaged with activities related to teaching and learning. As this lack of academic teaching background could have led to my overlooking interesting findings in the data, scrutiny of the analysis process by the project supervisors, who have expertise in teaching and learning, offered additional insights and minimised this potential limitation.

8.5 Trustworthiness of the findings

The research project presented in this thesis has employed a mixed methods approach, which allowed the credibility of the findings to be maximised. In order to ensure the achievement of realistic quality and integrity of the research findings, validity and reliability issues were addressed for each stage of this research. The steps that were taken to ensure the rigour and trustworthiness of the qualitative and the quasi-experimental studies were also highlighted (section 3.7). For example, in the qualitative research, the project supervisors were actively engaged in the data analysis process by reviewing the coding of raw data, the generated themes and the analytic narratives. In addition, the researcher's subjectivity was addressed in the reflexivity section (page 236). Threats to validity and reliability are clearly highlighted and acknowledged in the limitations of the research section below.

8.6 Limitations of the research

The research had the following limitations:

- The quasi-experimental study design has altered the typical traditional lecture class size. In other words, dividing the cohort into two groups has reduced the class size by half. This means the findings of the study might not be able to be generalised to the usual traditional lecture classroom setting, which is often larger in size.
- The subject matter in which the study was conducted was management of rheumatoid arthritis, which is a pharmacy practice topic. Thus, generalising the study findings to science-based subjects such as pharmacology and chemistry is not possible.
- The teaching sessions in which the study was conducted were extra-curricular and not examinable. Therefore, the number of students who attended the teaching sessions was far lower than the total number of recruited students, particularly at UCL. To expand upon the point, at UCL, around 50% of recruited students attended the lecture group, and about 40% of those recruited attended the flipped classroom group. Conversely, at UOP, all recruited students attended the flipped classroom session, and approximately 78% of recruited students attended the traditional lecture group. This could have introduced bias to the study findings in a number of ways. First, the class size at UCL for both the traditional lecture and the flipped classroom groups was further reduced as a result of absent students. This could have been advantageous, as it might have positively impacted the class dynamic, particularly for the flipped classroom group. Thus, a different group dynamic could have occurred if all recruited students had attended. Consequently, less favourable results could have been achieved. Second, it was likely that attendees at UCL sessions were the most keen and academic students. Thus, findings from UCL do not represent the entire year four MPharm students.
- The study was conducted with year four MPharm students. This group of students were in their final year of the MPharm programme. Thus, they were more mature and had experienced various learning environments. In addition, their skills and autonomy might have been better than those in the early years of the MPharm programme. Accordingly, the findings cannot be extended to the other year groups.

- The current study has adapted the CUCEI survey to fit into the study context taking into account the traditional lecture and flipped classroom considerations. Thus, rewording and deleting some of the survey items could have threatened its internal consistency reliability and discriminate validity.
- The large proportion of missing data on the learning style variable (around 19% across the entire dataset) has resulted in sample size reduction when studying the association between learning styles and student preference for the traditional lecture and the flipped classroom teaching methods. This could have resulted in reducing the statistical power of the Kruskal-Wallis H Test. Another limitation was that the LSI was given to students at post-test only. Therefore, the experience of the flipped classroom might have had an influence on how students responded to the LSI.
- Findings from the formative assessment for UOP do not represent the performance of all the sessions' attendees since around half of the students did not submit their answers. This was due to unavailability of TurningPoint keypads at the time of the teaching. To illustrate this further, each MPharm student at UOP is given a personal TurningPoint keypad to use during the programme. Thus, it is the students' responsibility to carry the keypad with them when it is required. Conversely, these gadgets are available for MPharm students at UCL to borrow during teaching sessions.
- In each pharmacy institution, only one focus group was conducted before the flipped classroom experiment and one focus group after the delivery of the flipped classroom session. Most of the participants who took part in the four focus groups were females (85%). Therefore, views of male participants are underrepresented in the qualitative studies.

8.7 Further research

This study has addressed students' perspective on the flipped classroom teaching method. Investigating academic staff's perception of the flipped classroom teaching method may provide valuable insight that enables higher

education institutions to address impediments to implementation. In addition, the study presented in this thesis has investigated students' perspective on implementing a flipped classroom to teach management of rheumatoid arthritis, which is categorised as a pharmacy practice topic. Findings that emerged from the focus group data suggested that the flipped classroom teaching method could be more beneficial for concepts that require application of knowledge. Accordingly, further studies that compare the effectiveness of the flipped classroom teaching method across different subject areas of the MPharm curriculum are recommended.

Learning styles of MPharm students were found to have no influence on students' level of preference for the traditional lecture and the flipped classroom. This research concludes that using a flipped classroom would not disadvantage a particular learning style, however, this could have been affected by the small size of the study sample since there was a large amount of missing data on student learning styles. Thus, it is recommended that further studies with a larger sample size be conducted to confirm this finding.

This study looked at the immediate effect of the flipped classroom on students' retention of knowledge. Further area of research could include studies that look at the long-term effect of the flipped classroom on retention and application of knowledge. Further studies that investigate the impact of the flipped classroom implementation on new concepts or difficult subjects are recommended. This would enable us to understand whether or not the flipped classroom is appropriate in that context.

This study has investigated year four students' perceptions of the flipped classroom. This group of students are in their final year of the MPharm programme and they might be more comfortable with self-study than their younger fellows. Therefore, it would be recommended to conduct a similar study with different year groups of the MPharm programme. This will enable us to understand the unique needs of young pharmacy students to inform

good practices for implementing the flipped classroom across the MPharm programme.

This research has employed a focus group approach to collect data for the qualitative studies. Recruiting students for the focus groups was a challenge and this was primarily due to the students' timetable differences. In addition, students whose first language is not English might have felt uncomfortable with participating in a group discussion that contains native English participants. Thus, future research could employ an individual interviews approach instead of focus groups. This would allow the recruitment of a higher number of participants, and therefore create more variability within the sample. This might enable the exploration of individual differences that may not come out in focus groups. It is also recommended that further studies address individual differences by collecting demographic data on first language and learning difficulties, such as dyslexia, in addition to age and gender.

Given that the culture and social background of Saudi students may be different from those in the current study and in the published international research on the impact of the flipped classroom in pharmacy education, it would be interesting to determine whether the benefits of this innovative teaching method are also achieved in the Saudi Arabian context. Thus, with the paucity of research investigating the implementation of this teaching method in Saudi pharmacy institutions, conducting a similar study in Saudi Arabia will be of great interest. It will inform the best practices for the flipped classroom implementation in that context.

Chapter 9 Conclusion

This chapter provides an overview of how this research has achieved the aims and objectives of the thesis.

This research project sought to investigate the feasibility, acceptability and effectiveness of the flipped classroom teaching method in relation to undergraduate pharmacy students in two pharmacy schools in the UK: UCL School of Pharmacy and the School of Pharmacy and Biomedical Sciences at Portsmouth University. The thesis objectives were provided at the beginning of the thesis (Page 18), and to address them, a two-stage mixed methods research study was conducted.

The first stage of this research involved a qualitative study using a focus group approach. This study allowed the factors that influence the learning experience of MPharm students to be highlighted in depth. In addition, it addressed students' perception of the traditional lecture and the flipped classroom approach, which contributed to providing confirmatory and/or expansionary accounts for stage II when exploring students' satisfaction with and attitudes towards the flipped classroom, and in documenting the challenges linked to its implementation.

Stage II of this research involved conducting a quasi-experimental, mixed methods study that enabled a comparison of students' satisfaction and knowledge acquisition between the flipped classroom and traditional lecture to be carried out. In addition, this stage examined the association between students' learning styles and their perception of the flipped classroom. The second phase of this study involved conducting focus groups, which provided in-depth insights on students' perspectives on the flipped classroom teaching method. In addition to contributing to the achievement of the above-mentioned objectives, this stage of the current research led to the achievement of another objective of the thesis, which was 'to determine the impact of the flipped classroom teaching model on students' knowledge acquisition'.

The final objective of this thesis was ‘to ascertain ways to improve implementation of the flipped classroom teaching method’. Both stages of this research together with the literature review on adult learning and implementing the flipped classroom, contributed to the achievement of this particular objective.

Overall, implementing the flipped classroom teaching approach to teach a CPD session on management of rheumatoid arthritis was successful at both pharmacy institutions: UCL School of Pharmacy in London and the School of Pharmacy and Biomedical Sciences at University of Portsmouth. This innovative teaching approach was well received by the final year MPharm students, and it was preferred over the traditional lecture. Barriers and recommendations for successful flipped classroom implementation have been highlighted in this study.

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Appendices

Appendix 1: Literature Review

No		1
Title		Using the flipped classroom in graduate nursing education
Journal		Nurse Educator
Author/ Date/ Country		Critz and Knight/ 2013/ USA
Aim(s) of Study		To determine how students felt about taking charge of their own learning prior to coming to class, and then applying that new knowledge during class time
Design		Intervention study, non-comparative
Discipline/ Course		Nursing/ pediatric
Students	Year group	Graduate level education
	Mean age	Not stated
Lecturer		The cohort was taught by the same lecturer
The control group	Date	No control group/ not comparative study
	Teaching Approach	
	Sample size	
The study group (flipped classroom approach)	Date	Not specified
	Duration of study	11 weeks
	Sample size	20 Students
	Out of class activities	▪ Viewing pre-recorded lectures ▪ Reading textbook materials ▪ Reading journal articles ▪ Online quizzes
	In class activities	▪ Intensive case studies ▪ Role playing ▪ Group problem-solving exercises ▪ Occasional use of lectures by both peers and faculty
	Recorded lectures	Pre-recorded lectures were 20-40 minutes in length.
	Orientation	None
	Motivation	Graded online quizzes
	Assessment instrument	Students' perception survey
Results	Major findings	▪ Students were generally positive about the new instructional pedagogy ▪ Students comments on listening to in-class lectures by peers indicates that this strategy is not favourable
	Analysis method	Descriptive statistics and descriptive content analysis
Conclusion		Although this study was based on a small number of students and faculty, it was overwhelmingly

		successful. Students took charge of their own learning and became far more engaged in classroom discussions
Comments	Strengths	▪ Study was conducted over 11 weeks period
	Weaknesses	▪ Small sample size ▪ There is no evidence of the validity and reliability of the survey instrument ▪ The response rate on the survey was not reported ▪ Results are not transferable to another setting or a wider population

No		2
Title		Looking at the impact of the flipped classroom model of instruction on undergraduate multimedia student at CSUN
Journal		Technology trends, Washington DC
Author/ Date/ Country		Enfield/ 2013/ USA
Aim(s) of Study		To investigate the effectiveness of the flipped classroom instructional approach, and if deemed worthwhile, identify ways to improve upon it
Design		Intervention study, non-comparative
Discipline/ Course		Multimedia/ Computer fundamentals for multimedia
Students	Year group	Not stated, undergraduate level
	Mean age	Not stated
Lecturer		Both sections were taught by the same lecturer
The control group	Date	No control group/ non-comparative study
	Teaching Approach	
	Sample size	
The study group (flipped classroom approach)	Date	2013
	Duration of study	One semester
	Sample size	50 Students
	Out of class activities	Either viewing recorded lectures or completing assigned reading materials
	In class activities	▪ Quiz ▪ Instructor-led demonstration of new concepts ▪ Instructor-led demonstration of videos previously introduced in videos ▪ Group activities and tasks to practice concepts and skills previously learned ▪ Open lab time to work on assigned projects
	Recorded lectures	38 videos were created by the lecturer (13.5 hours in total). QuickTime player was used for

		screen and audio capture, and Miro Converter was used to compress the original files to mp4 and webm files
	Orientation	None
	Motivation	Students were given a short quiz at the beginning of each class session
	Assessment instrument	Students' perception survey
Results	Major findings	▪ The quiz was a strong stimulus for students to prepare for the scheduled class ▪ Students were positive about the flipped classroom model ▪ Instructional videos were perceived as engaging, helpful and appropriately challenging ▪ The in-class activities were reported to be engaging
	Analysis method	Descriptive statistics
Conclusion		The flipped classroom model is one possible step towards a more customised learning environment. The approach encourages students to move out of the classroom to learn anytime and anywhere
Comments	Strengths	▪ 74 % of students completed the survey ▪ Study conducted over one semester
	Weaknesses	▪ No information was provided on students' characteristics and demographics ▪ There was no evidence of the validity and reliability of the survey instrument ▪ Results are not transferable to another setting or a wider population

No		3
Title		Inverting the classroom: A gateway to creating an inclusive learning environment
Journal		Journal of Economic Education
Author/ Date/ Country		Lage et al./ 2000/ USA
Aim(s) of Study		To outline a strategy for teaching that appeals to a broad range of learning styles without violating the constraints typically faced by lecturers at most institutions. Additionally, to present student and faculty perception of such a course
Design		Intervention study, non-comparative
Discipline/ Course		Economic/ principles of microeconomics
Students	Year group	Second academic year of an undergraduate programme

	Mean age	Not stated
Lecturer		Two different lecturers were involved in teaching 5 sections of the course
The control group	Date	No control group, not a comparative study
	Teaching Approach	
	Sample size	
The study group (flipped classroom approach)	Date	1996
	Duration of study	One semester
	Sample size	40 Students X 5 sections (total: 200 Students)
	Out of class activities	▪ Viewing video lectures ▪ Completing reading materials ▪ Completing worksheets
	In class activities	▪ A min-lecture of approximately 10 minutes if students had questions ▪ Working on an economic experiment or lab that corresponded to the topic being covered ▪ Discussing worksheets ▪ Review questions period
	Recorded lectures	Either video-taped lectures or lectures with PowerPoint and sound. They were available for viewing and coping in school labs. Approximately 2 hours were required to record each lecture
	Orientation	None
	Motivation	Randomly collecting worksheets and grading them for completeness
	Assessment instrument	▪ Student perception survey ▪ Lecturers' opinion
Results	Major findings	▪ The results from both students' survey and lecturers' opinion showed that the flipped classroom teaching model was preferred over the traditional lecture-based method of teaching ▪ The evidence suggested that this method increased the interaction between students and the instructor ▪ Additionally, it has led to improved students' communication skills and provided flexibility in learning the content in different formats
	Analysis method	Descriptive statistics
Conclusion		Evidence suggests that students generally preferred the inverted classroom to a traditional lecture and would prefer to take future economics classes using the same format
Comments	Strengths	▪ All assignments, tests and exercises were identical in both lectures' classrooms ▪ The response rate on student survey was

		94.5% ▪ Study conducted over one semester
	Weaknesses	▪ The 5 sections of the flipped classroom were taught be 2 different lecturers ▪ There was no evidence of the validity and reliability of the survey instrument ▪ Results are not transferable to another sitting or a wider population

No		4
Title		Student learning and perceptions in a flipped linear algebra course
Journal		International Journal of Mathematical Education in Science and Technology
Author/ Date/ Country		Love et al./ 2013/ USA
Aim(s) of Study		To compare the effectiveness of two teaching methods (a traditional lecture and a flipped style) in a sophomore-level linear algebra course at a mid-sized metropolitan university
Design		Quasi-experiment
Discipline/ Course		Mathematics/ Applied linear algebra
Students	Year group	Second academic year of an undergraduate programme
	Mean age	Not stated
Lecturer		Both sections were taught by the same lecturer
The control group	Date	2012
	Teaching Approach	Traditional lecture-based approach
	Sample size	28 Students
The study group (flipped classroom approach)	Date	2012
	Duration of study	One semester
	Sample size	27 Students
	Out of class activities	▪ Viewing online screencasts ▪ Completing a readiness test
	In class activities	Interactive hands on activities
	Recorded lectures	They were created using LaTeX beamer package. The average length of a class video was around 30 minutes
	Orientation	None
	Motivation	Pre-class readiness assessment
	Assessment instrument	▪ Students' opinion survey ▪ Comparison of student progress in mid-term exams ▪ Comparison of final exam grades
Results	Major	▪ Students' progress through three mid-term

	findings	exams was compared. The results showed that students' progress was significantly greater for the flipped classroom students when compared to that of the traditional lecture format cohort (P<0.034 and P<0.012) ▪ Final exam grades comparison revealed no significant difference between the two cohorts ▪ The results of the survey indicated that 74% of students in the flipped classroom cohort were positive about the new class format
	Analysis method	Non-parametric Mann–Whitney *U* test and descriptive statistics
Conclusion		Flipped classroom approach holds significant promise for successful implementation in STEM disciplines and may support improved student outcomes in STEM courses that are typically considered challenging by students
Comments	Strengths	▪ Both sections were taught by the same lecturer ▪ Students agreed to participate in the study chose the time slot that fit into their schedule and were unaware of the method of instruction until the first day of class ▪ Study conducted over a relatively long period (one semester)
	Weaknesses	▪ Authors claimed that students performed similarly on final exams. However, there was no evidence of performing statistical analysis on the final exam scores ▪ The survey response rate was not reported ▪ The characteristics of both groups were not stated and nor compared ▪ There was no evidence of the validity and reliability of the survey instrument ▪ There were no power calculations. Therefore, the sample size was not justified ▪ Results cannot be generalised on another setting or a wider population

No	5
Title	Comparing the effectiveness of an inverted classroom to a traditional classroom in an upper-division engineering course
Journal	IEEE Transactions on Education
Author/ Date/ Country	Mason et al./ 2013/ USA
Aim(s) of Study	To compare the effectiveness of an inverted classroom to a traditional classroom in three areas: 1) content coverage; 2) student performance on

		traditional quizzes and exam problems; and 3) student observations and perception of the inverted classroom format
Design		A control-treatment experiment
Discipline/ Course		Engineering/ control system
Students	Year group	Fourth year undergraduate students
	Mean age	Not stated
Lecturer		Same lecturer for both cohorts
The control group	Date	Not specified
	Teaching Approach	Traditional-lecture based classroom
	Sample size	20 Students, 18 male, 2 female
The study group (flipped classroom approach)	Date	Not specified
	Duration of study	10 weeks
	Sample size	20 Students, 16 male, 4 female
	Out of class activities	▪ Viewing video lectures ▪ Completing assigned readings ▪ Homework
	In class activities	Individual or group exercises
	Recorded lectures	45 videos were recorded, each between 5 and 15 minutes long. Each video took approximately one hour to record and 1-2 hours to edit. Videos were posted on YouTube so they were easily accessible to students
	Orientation	None
	Motivation	None
	Assessment instrument	▪ Assessing student perception by survey and class discussion ▪ Comparing content coverage by observation ▪ Comparing student performance on open-ended design problems ▪ Comparing student performance on comparable quizzes and exams
Results	Major findings	▪ Students' performance on comparable quizzes, exams and open-ended problems in the flipped classroom was similar to or better than that of the traditional model ▪ The instructor was able to cover more materials in the inverted classroom ▪ Students reported that they were initially unsatisfied with the new teaching format, but they adjusted rapidly ▪ Students' satisfaction survey and in-class discussion indicated that the flipped classroom was perceived by students to be effective and satisfactory format to teach control systems

	Analysis method	*t*-test and descriptive statistics
Conclusion		Not only was the instructor able to cover more material in the inverted classroom than in the lecture class, but students also demonstrated equal or better quiz and exam performance and better scores on design problems, adopted to the format fairly quickly, and showed equal or greater satisfaction
Comments	Strengths	▪ Both cohorts were taught by the same lecturer in two successive years ▪ Assessment were similar in both years ▪ Timing were considered in matching problems between the study and control group ▪ Problems matching were performed by the lecturer, a co-author and an adjunct faculty who is familiar with the course ▪ The in-class discussion performed to determine student perception of the flipped classroom was facilitated by a faculty member not teaching the course ▪ The study and control groups were very similar in their background and ability
	Weaknesses	▪ The response rate on the survey was not reported ▪ There were no power calculations ▪ There was no evidence of the validity and reliability of the survey instrument ▪ Results cannot be generalised to another setting or a wider population

No		6
Title		The flipped classroom: A course redesign to foster learning and engagement in a health professions school
Journal		Journal of the Association of American Medical Colleges
Author/ Date/ Country		McLaughlin et al./ 2013/USA
Aim(s) of Study		To describe the philosophy and methodology used in the course redesign and to outline the research conducted to investigate the outcomes of the flipped classroom
Design		A design experiment
Discipline/ Course		Pharmacy/ Basic pharmaceutics II
Students	Year group	First year professional students
	Mean age	Not stated
Lecturer		One lecturer was involved in delivering the lecture

		content of the course for both teaching groups. However, either the lecturer or a teaching assistance facilitated different sections of the flipped classroom approach
The control group	Date	2011
	Teaching Approach	Traditional lecture format, which consisted of a 75-minute lecture and an occasional 15-minute active learning activity (quiz or share and pair activity)
	Sample size	153 Students
The study group (flipped classroom approach)	Date	2012
	Duration of study	13 weeks, 25 classes (each lasting 75 minutes)
	Sample size	162 Students
	Out of class activities	▪ Viewing online videos ▪ Assigned textbook and background readings
	In class activities	Four active learning exercises (75 minutes): ▪ Audience response and open questions ▪ Pair and share activities ▪ Student presentation and discussion ▪ Individual or paired quiz And micro-lectures (2-3) minutes, as needed
	Recorded lectures	25 lectures were pre-recorded using Echo360 classroom capture and they were made available for students to view on a web-based learning management system. The average length of each recorded lecture was 34.6 minutes (range of 21-55 minutes).
	Orientation	Students were provide with: ▪ A comprehensive syllabus that included a thorough description of the course and explanation of motivations for course redesign ▪ A guide this tips for success in the course
	Motivation	Students received 1.6% bonus points for responding online to reflective pair and share questions, and 3.2% bonus points for facilitating a proactive pair and share activity
	Assessment instrument	▪ Pre- and post-course survey ▪ Comparison of student performance on final exams ▪ Comparison of end of semester course evaluation scores
Results	Major findings	▪ Students' perception of the inverted classroom format was mainly favourable ▪ The number of students who believe that the assigned reading materials enhanced their learning has significantly dropped in the post-course survey ▪ Comparing the final exam grades (out of 200)

		of the traditional (160.06 ± 14.65) and the flipped model (165.48 ± 13.34) showed a significantly statistical difference (p= 0.001)
	Analysis method	*t*- test
Conclusion		Flipping the traditional classroom is both a feasible and a necessary move to educate a large cohort of students
Comments	Strengths	▪ Study conducted over a long period of time (13 weeks, 25 lectures) ▪ The study and the control groups were of similar characteristics ▪ 92% of students completed the opinion survey and 100% completed the end of term course evaluation
	Weaknesses	▪ No evidence of the validity and reliability of the survey instrument ▪ Results cannot be generalised to another sittings or a wider population ▪ No power calculations ▪ Different sections of the flipped classroom model were facilitated by two different academic staff

No		7
Title		Flipping the classroom to improve student performance and satisfaction
Journal		Journal of Nursing Education
Author/ Date/ Country		Missildine et al./ 2013/ USA
Aim(s) of Study		To determine the effects of a flipped classroom and innovative learning activities on academic success and the satisfaction of nursing students
Design		Quasi-experiment
Discipline/ Course		Nursing/ adult health
Students	Year group	Not stated
	Mean age	Mean age of students 24.32 (*SD*=6.71)
Lecturer		It is not clear whether or not the three groups were taught by the same lecturer
The control group	Date	2009 and 2010
	Teaching Approach	Traditional lecture-based format Traditional lecture and pre-recorded lectures
	Sample size	172 Students in the traditional lecture group 171 Students in the traditional lecture and pre-recorded lecture group
The study group (flipped	Date	2010
	Duration of study	2 semesters

classroom approach)	Sample size	246 Students
	Out of class activities	Viewing pre-recorded lectures
	In class activities	Interactive activities
	Recorded lectures	Lecture content was electronically recorded through lecture capture software
	Induction	None
	Motivation	None
	Assessment instrument	▪ Comparison of examination scores ▪ Students' perception survey
Results	Major findings	▪ Students in the flipped classroom group (*M*=81.89, *SD*=5.02) significantly outperformed those in the traditional lecture only (*M*=79.79, *SD*=4.51) and traditional lecture with pre-recorded lecture (*M*=80.7, *SD*=4.25) groups (*P*<0.001) ▪ Students in the flipped classroom group were less satisfied than those in either of the other groups (*P*<0.001)
	Analysis method	ANOVA and Kruskal-Wallis test
Conclusion		Blending new teaching technologies with interactive classroom activities can result in improved learning but not necessarily improved student satisfaction
Comments	Strengths	▪ Power calculations were performed and the sample size was large enough to detect any statistical difference between the groups ▪ The internal reliability of the survey instrument was assessed using Cronbach's coefficient alpha and the results indicated good internal consistency across the sample ▪ The response rate on the survey was 75.55%
	Weaknesses	▪ It is not clear whether or not the three groups were taught by the same lecturer

No	8
Title	Learn before lecture: A strategy that improves learning outcomes in a large introductory biology class
Journal	Cell biology education
Author/ Date/ Country	Moravec et al./ 2010/ USA
Aim(s) of Study	To determine whether learn before lecture strategy is effective in increasing learning
Design	Comparative intervention study

Discipline/ Course		Biology/ Introductory biology
Students	Year group	Not stated
	Mean age	87% were 18 years
Lecturer		Same lecturer in the three cohorts
The control group	Date	2007 and 2008
	Teaching Approach	Traditional-lecture based format
	Sample size	438 Students and 872 Students
The study group (flipped classroom approach)	Date	2009
	Duration of study	3 sessions
	Sample size	795 Students
	Out of class activities	Either a narrated PowerPoint video with a notetaking sheet or a one-page worksheet (a short reading assignment and questions)
	In class activities	▪ An interactive demonstration ▪ Clicker questions ▪ Problem-based small group discussion, and/or class discussion
	Recorded lectures	Pre-recorded lectures were PowerPoint slides used the previous year narrated by the same faculty. The videos were made using Camtasia Relay software.
	Orientation	None
	Motivation	▪ A credit worth one-percent of the total grade was allocated for uploading and completing an assignment ▪ Students receive 0.25% credit of the final grade for completing an online test
	Assessment instrument	▪ Comparison of final exam grades with previous years ▪ Students' perception survey
Results	Major findings	▪ Final exam comparison with the previous two years classes showed that students in flipped classroom achieved significantly higher scores than those in the traditional biology class ($p < 0.001$) ▪ The majority of students were in favour of the new class format
	Analysis method	Fisher's exact test
Conclusion		This approach of teaching can help busy faculty transform large lecture halls into more active learning environments that support increased student learning gains
Comments	Strengths	▪ The pre class academic indices of the cohorts were similar
	Weaknesses	▪ A short period study ▪ Sample size was not justified as there were

		no power calculations ▪ One of the comparable questions was identical between years ▪ Only 56% of students completed the perception survey ▪ The results of the survey were not reported comprehensively ▪ There is no evidence of the validity and reliability of the survey instrument

No		9
Title		Vodcasts and Active-Learning Exercises in a "Flipped Classroom" Model of a Renal Pharmacotherapy Module
Journal		American Journal of Pharmaceutical Education
Author/ Date/ Country		Pierce and Fox /2012/ USA
Aim(s) of Study		To implement a "flipped classroom" model for a renal pharmacotherapy topic module and assess the impact on pharmacy students' performance and attitudes
Design		A design experiment
Discipline/ Course		Pharmacy/ Renal pharmacotherapy module within the integrated pharmaceutical care and science series
Students	Year group	8% had 1-2 years of undergraduate education 11% had associates degrees 20% had more than three years of undergraduate education 58% has bachelor's degrees 1% had master's degree
	Mean age	Not stated
Lecturer		Both cohorts were taught by the same lecturer
The control group	Date	2011
	Teaching Approach	Traditional-lecture based format
	Sample size	Not specified
The study group (flipped classroom approach)	Date	2012
	Duration of study	4 hours lecture content (4 vodcasts), 2 patient cases (90 minutes each)
	Sample size	71 Students; 30 male; 41 female
	Out of class activities	Vodcasts (video podcasts)
	In class activities	POGIL activity (interactive cases of patients with end stage renal disease)
	Recorded lectures	The vodcasts were course lectures that were originally performed live in spring 2011 and made available for viewing on **iTunes U**

		platform. Lectures are recorded in a voiceover slideshow format using **Camtasia Relay**
	Orientation	None
	Motivation	None
	Assessment instrument	▪ Pre-test and post-test (flipped classroom group) ▪ Comparison of student performance on the 2011 and 2012 final examination questions ▪ Students' perception survey measuring two domains: students' attitude towards the in-class activity, and the flipped classroom approach
Results	Major findings	▪ A significant difference between the pre-test (33.5 $\pm$ 11.6 [mean $\pm$ SD], range 0-59) and post-test (79.2 $\pm$ 10.6) [mean $\pm$ SD], range 53-100) scores, $P<0.001$ ▪ The flipped classroom group achieved significantly higher grades (81.6 + 4.4, range 43-100) than the traditional lecture group (77.7 + 4.7, range 43-100), $P=0.024$ ▪ The overall survey response rate was 73% and the majority of students were in favour of the flipped approach and the POGIL activities
	Analysis method	▪ Descriptive statistics ▪ *t* -test
Conclusion		The implementation of the flipped class in this study accompanied improved student performance and generated positive student attitudes towards the experience
Comments	Strengths	▪ Both groups were taught by the same lecturer ▪ 73% of participants completed the survey ▪ Cronbach alpha measure of reliability is $\geq$ 0.8 for both domains of the survey
	Weaknesses	▪ Descriptive study ▪ Lack of baseline measurement for the control group ▪ Identical final examination questions ▪ Sample size and characteristics of the control group were not reported ▪ The number of participants in the study was not justified (no power calculation) ▪ Results cannot be generalised to another sittings or a wider population

No		10
Title		Student attitudes towards flipping the general chemistry classroom
Journal		Chemistry Education Research and Practice
Author/ Date/ Country		Smith/ 2013/ USA
Aim(s) of Study		To determine student attitudes towards flipping the general chemistry classroom
Design		Intervention study, non-comparative
Discipline/ Course		Chemistry/ General chemistry
Students	Year group	Not stated
	Mean age	Not stated
Lecturer		All groups were taught by the same lecturer
The control group	Date	No control group, not a comparative study
	Teaching Approach	
	Sample size	
The study group (flipped classroom approach)	Date	Not specified
	Duration of study	The trial of flipping the classroom was performed for a total of four sections of general chemistry I and three sections of general chemistry II over 2 years
	Sample size	235 Students
	Out of class activities	▪ Pre-recorded lectures ▪ Online homework
	In class activities	▪ Question and answer period related to the video lecture ▪ Quiz (graded in the second year of trial) ▪ Problem solving exercises
	Recorded lectures	Pre-recorded lectures were delivered to students through the Mediasite® software platform, which allows for streaming content delivery. 200 mini-lectures of narrated PowerPoint presentations were recorded. They ranged in length from 1:08 to 17:02.
	Induction	None
	Motivation	Graded quizzes (in the second year of trial)
	Assessment instrument	Students' perception survey
Results	Major findings	Students found flipping the classroom burdensome, but yet beneficial in numerous aspects
	Analysis method	Descriptive statistics
Conclusion		Flipping the classroom, though perceived by students to be a time burden, was also perceived by students to be advantageous in multiple ways
Comments	Strengths	▪ Study conducted over a long period of time (two years) ▪ Study based on a relatively large sample size

		▪ All groups were taught by the same lecturer
	Weaknesses	▪ There was inconsistency in the implementation process of the flipped classroom throughout the years. The in-class quizzes, for instance, were not graded in the first trial of this approach ▪ There was no evidence of the validity and reliability of the survey instrument ▪ The response rate of the survey was not stated in the study ▪ Characteristics of participants, e.g. mean age and academic year were not reported ▪ Results cannot be generalised to another sitting or a wider population

No		11
Title		How learning in an inverted classroom influences cooperation, innovation and task orientation
Journal		Learning environments research
Author/ Date/ Country		Strayer/ 2012/ USA
Aim(s) of Study		To compare the learning environments of an inverted introductory statistics class with a traditional introductory statistics class at the same university
Design		Mixed method research study
Discipline/ Course		Statistics/ Introductory statistics
Students	Year group	First and second year undergraduate students
	Mean age	Not stated
Lecturer		Same lecturer for the control and study group
The control group	Date	2004
	Teaching Approach	Traditional lecture-based format
	Sample size	26 Students, 13 female, 13 male
The study group (flipped classroom approach)	Date	2004
	Duration of study	One semester
	Sample size	23 Students, 12 female, 11 male
	Out of class activities	Working on a computer module (an intelligent tutoring system)
	In class activities	Small group activities
	Recorded lectures	An intelligent tutoring system was used to deliver the knowledge-based content of the course outside the class
	Orientation	Students were given a syllabus on how the class was structured
	Motivation	None
	Assessment	▪ Quantitative data (Student perception by

	instrument	using college and university classroom environment inventory survey) ▪ Qualitative data (field notes were collected to gain insight into student behaviour; other data were collected at the beginning, middle and end of semester; one-one and focus-group interviews at the end of semester ▪ A case study
Results	Major findings	▪ Students in the flipped classroom group felt less satisfied with how the classroom structure oriented them to the learning activities in the course (they had difficulty in making sense of some of their learning activities) ▪ Students in the flipped classroom found it difficult to connect the online and face to face portions of the course ▪ Students in the flipped classroom were in favour of the corporative learning and innovative teaching strategies offered by the new course structure
	Analysis method	Mixed methods data analysis
Conclusion		The flipped classroom approach is not the ideal design for introductory courses as students has a low interest in the subject and encountering challenges may frustrate them
Comments	Strengths	▪ The lecturer was not involved in collecting the data from one-one and focus group interviews ▪ The survey instrument used to measure students' perception has an acceptable internal consistency, with a Cronbach's alpha coefficient ranging from 0.7 to 0.9 ▪ The survey instrument has a discriminate validity ▪ The study combined mixed method design (triangulation) ▪ Both groups were taught by the same lecturer
	Weaknesses	▪ Due to lack of random assignment, generalisation to another sitting or a larger population cannot be made ▪ The study took place in the researcher's own classroom ▪ The response rate on the survey instrument was not reported

No		12
Title		Flipped classroom model improves graduate student performance in cardiovascular, respiratory and renal physiology
Journal		Advances in Physiology Education
Author/ Date/ Country		Tune et al./ 2013/ USA
Aim(s) of Study		To assess the effectiveness of a lecture-based curriculum versus a modified flipped classroom curriculum of cardiovascular, respiratory and renal physiology delivered to first year graduate students
Design		Quasi- experiment
Discipline/ Course		Medicine/ cardiovascular, respiratory and renal physiology
Students	Year group	First year graduate students
	Mean age	Not stated
Lecturer		Both groups were taught by the same lecturer
The control group	Date	2013
	Teaching Approach	Traditional lecture-based format and an access to pre-recorded lectures
	Sample size	14 Students, 12 male, 2 female
The study group (flipped classroom approach)	Date	2013
	Duration of study	Not specified
	Sample size	13 Students, 3 male, 10 female
	Out of class activities	Viewing pre-recorded lectures
	In class activities	▪ Quizzes/ written homework assignments ▪ Question and answer/ problem-solving exercises
	Recorded lectures	Students enrolled in the modified flipped course were not presented “live” lectures but were required to watch the recorded lectures from the traditional course before class
	Orientation	None
	Motivation	Graded in-class quizzes or homework
	Assessment instrument	▪ Comparisons of student performance on multiple choice exams ▪ Students’ perception survey
Results	Major findings	▪ Students in the flipped classroom cohort outperformed those in the traditional lecture-based cohort ($P \leq 0.05$ for the cardiovascular and respiratory; $P = 0.06$ for the renal part) ▪ Students were generally positive about the new instructional strategy and they become more enthusiastic about it towards the end of the course ▪ Some students were critical about the high workload, and having quizzes before the

		group discussion and the questions and answers period
	Analysis method	*t*-test and descriptive statistics
Conclusion		Initial experience with a version of a flipped classroom model for cardiovascular, respiratory and renal physiology was largely positive
Comments	Strengths	▪ Students were assessed by identical exam questions ▪ Both cohort were taught by the same lecturer ▪ There were no differences in undergraduate grade point average (GPA) or average standardised test scores between the two cohorts ▪ All students completed the survey
	Weaknesses	▪ Duration of the study and the length of each pre-recorded lecture and class were not specified ▪ More women were enrolled in the flipped course, whereas more men were enrolled in the traditional course ▪ No power calculations. Therefore, the sample size was not justified ▪ There is no evidence of the validity and reliability of the survey instrument ▪ Results cannot be generalised on another setting or a wider population

Appendix 2: UCL Data Protection Registration Form

Finance and Business Affairs
Legal Services

Application for inclusion of a research project

All sections must be completed before submitting this form to the data protection team.

All research projects using personal data must be registered with the UCL Data Protection Officer **before the data is collected.** This includes projects approved by the Joint Research Office.

It is rarely necessary to store electronic personal data on portable devices such as laptops, USB flash drives, portable hard drives, CDs, DVDs, or any computer not owned by UCL. Similarly, manual personal data should not be regularly removed from UCL premises. In the case of electronic data, to minimise the risk of loss or disclosure, a secure remote connection to UCL should be used wherever possible.

The UCL Computer Security Team has published guidance on the storage of sensitive data on portable devices and media which is available at http://www.ucl.ac.uk/informationsecurity/itsecurity/knowledgebase/securitybaselines/encryption/GuidanceStorageSensitiveData

If storing sensitive data on portable devices or media all data must be strongly encrypted. ADS general encryption guidance is available at http://www.ucl.ac.uk/isd/staff/ads/help/guides/encryption .

Manual personal data and portable electronic devices should be stored in locked units, and they should not be left on desks overnight or in view of third parties.

Anonymised data Projects using anonymised data do not have to be registered with the Data Protection Team and you do not have to worry about compliance with the Act.

Data is only truly anonymised if it is impossible to identify subjects from that information and, if relevant, any other information that UCL holds. For example, if you have a list of research subjects and anonymise it by giving each one a number, but keep a list of the numbers with the names of the subjects, the information has not been anonymised. In this case, it is personal data, and the project must be registered with the Data Protection Team.

Approval We may have some questions about the information you provide, but you will normally be provided with a registration number within a week of submitting the form. However, the period leading up to meetings of the Ethics Committee is always very busy, and you should allow more time for your application to be processed. It is therefore very important to check in good time whether you need to register your project.

Please note that Data Protection Registration numbers will **NOT** be issued when you submit an application form in person to the Data Protection Team.

Please submit this form electronically and send to data-protection@ucl.ac.uk with copies of any information sheets and consent forms that you are using.

UCL Data Protection website

http://www.ucl.ac.uk/finance/legal_services/data_protection/data_protection.php

Any queries regarding this form please contact 020 3108 3128 (internal extension 53128)

This form will be returned to you with the appropriate registration number, which you may quote on your Ethics Application Form, or any other related forms.

Finance and Business Affairs
Legal Services
6th Floor, 1-19 Torrington Place
London WC1E 7HB

December 2013

Application for inclusion of a research project Form 2

A. APPLICATION DETAILS

A1	**Project Title: The impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the United Kingdom**	
	Date of Submission: 22/08/14	Proposed Start Date: 01/11/14
	UCL Ethics Project ID Number: 5832/001	Proposed End Date: 07/07/17

A2	**Principal Researcher** *(Please note that a student – undergraduate, postgraduate or research postgraduate cannot be the Principal Researcher for Ethics purposes).*	
	Full Name: Dr Angel Chater	
	Position Held: Lecturer in Health Psychology and Behavioural Medicine	
	Address:	
		Email:
		Telephone:

A3	**Data Collector(s) Details** *(if Applicant is not the Principal Researcher e.g. student details)*:	
	Full Name: Mona Abdulaziz Almanasef	
	Position Held: MPhil/PhD candidate	
	Address:	
		Email:
		Telephone:

B. DETAILS OF THE PROJECT

B1	Please provide a brief summary of the project This study will be conducted to assess the feasibility and effectiveness of the flipped classroom teaching format on undergraduate pharmacy students (MPharm) in two pharmacy schools in the United Kingdom: UCL School of Pharmacy in London and the School of Pharmacy and Biomedical Sciences at Portsmouth University. The design chosen to conduct this study is an experimental, mixed methods design. Two matching fourth-year modules from the MPharm programme in both schools will be chosen to deliver the flipped classroom intervention. The traditional lecture-based class will be replaced with a pre-recorded lecture supplemented with a formative, interactive online quiz. The scheduled face-to-face time will be spent on engaging students in different active learning exercises. A survey instrument will be used to compare students' perception of the flipped classroom with the traditional method of teaching. Students' perception will be further investigated by conducting focus groups, which will be carried out before the end of the module. Lecturers' perceptions of the flipped classroom instructional paradigm will be obtained by carrying out interviews. In order to assess the effect of the flipped classroom format on students' performance, students' grades on comparable test questions will be compared with the control group who receive a traditional teaching style.

C. DETAILS OF PARTICIPANTS

C1	**Data subjects** Who will the personal data be collected from? The personal data will be collected from year four undergraduate pharmacy students (MPharm) at the UCL School of Pharmacy (approximately 200 students) and the School of Pharmacy and Biomedical Sciences at Portsmouth University (approximately 100 students).
C2	**What data will be collected** Please provide details of the type of personal data to be collected Student identification numbers will be requested in the student perception survey in order to recruit and collect data only from those who agreed to participate. The information provided by participants will not be disclosed in any way that might identify that individual or that might enable the individual to be traced. Participants, also, will not be discussed with anybody else. Identifiers from the data released on individuals will be deleted.
C3	**Disclosure** Who will the results of your project be disclosed to? Findings will be presented at the UCL School of Pharmacy research day, national and international pharmacy conferences. Additionally, findings will be published in a scientific journal and a copy will be sent to all participants. All data will be anonymised.

D. CONSENT

D1	**Consent** Please include the information sheet and consent forms you will be using for this project, and or protocol If you are not including an information sheet and consent form, please explain why:

Please find attached the information sheet and consent form.

E. INTERNATIONAL TRANSFER

E1	**International Transfer** The eighth principle of the Data Protection Act 1998 prohibits the transfer of personal data to countries or territories outside the European Economic Area (which consists of the 27 EU member states, Iceland, Liechtenstein and Norway). At the time of writing the following countries have also been deemed adequate for the purposes of the 8th principle Argentina, Canada, Guernsey, Isle of Man, Jersey and Switzerland. If you intend to transfer data to a country not mentioned above, please supply details of adequate safeguards below: N/A

F. PUBLICATION

Will the results of your research be published in an academic journal or other publication? **YES / NO**

Please note that published results must not contain data by which an individual can be identified.

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Finance and Business Affairs
Legal Services
6th Floor, 1-19 Torrington Place
London WC1E 7HB

December 2013

G. NOTIFICATION

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G1	**Notification** (*Please note that notification is a prerequisite for registration)* Have you informed your department's Data Protection Coordinator about your project? **YES/NO**

G2	**Notification** (*Please note that notification is a prerequisite for registration)* Have you informed your department's computer representative about your project? **YES/NO**

H. ETHICS

H1	Are you applying to the UCL Research Ethics Committee? **YES/NO**
	Date of Ethics meeting: 13/10/2014

I. REGISTRATION

I1	**Registration:** *Office use only:*	
	UCL Data Protection Registration Number: Z6364106/2014/09/01	Data issued: 2014/09/01

Further information

For more information and guidance on the UCL Research Committee, please visit
http://ethics.grad.ucl.ac.uk/

When all essential documents are ready to archive, contact the UCL Records Office by email at records.office@ucl.ac.uk to arrange ongoing secure storage of your research records unless you have made specific alternative arrangements with your department, or funder.

For information on the UCL Records Management Service, please visit
http://www.ucl.ac.uk/efd/recordsoffice/policy/records-transfer

Finance and Business Affairs
Legal Services
6th Floor, 1-19 Torrington Place
London WC1E 7HB

December 2013

Appendix 3: UCL Ethics Approval Letter

UCL RESEARCH ETHICS COMMITTEE
ACADEMIC SERVICES

Dr Angel Chater
School of Pharmacy
UCL

4 December 2014

Dear Dr Chater

Notification of Ethical Approval
Project ID 5832/001: The impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the UK

In my capacity as Chair of the UCL Research Ethics Committee (REC) I am pleased to confirm that I have approved your study for the duration of the project i.e. **until December 2015.**

Approval is subject to the following conditions:

1. You must seek Chair's approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the 'Amendment Approval Request Form': http://ethics.grad.ucl.ac.uk/responsibilities.php

2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. Both non-serious and serious adverse events must be reported.

   Reporting Non-Serious Adverse Events
   For non-serious adverse events you will need to inform Helen Dougal, Ethics Committee Administrator (ethics@ucl.ac.uk), within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Chair or Vice-Chair of the Ethics Committee will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.

   Reporting Serious Adverse Events
   The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an independent expert. The adverse event will be considered at the next Committee meeting and a decision will be made on the need to change the information leaflet and/or study protocol.

On completion of the research you must submit a brief report (a maximum of two sides of A4) of your findings/concluding comments to the Committee, which includes in particular issues relating to the ethical implications of the research.

With best wishes for the research.

Yours sincerely

Professor John Foreman
Chair of the UCL Research Ethics Committee

Cc:
Mona Almanasef, Applicant
Dr Brian Pearce

Academic Service, 2 Taviton Street,
University College London Gower Street London WC1E 6BT
Tel: +44 (0)20 3108 4312
Email: ethics@ucl.ac.uk
http://ethics.grad.ucl.ac.uk/

Appendix 4: Amendment Approval Request Form

UCL RESEARCH ETHICS COMMITTEE

UCL

Amendment Approval Request Form

1	**Project ID Number:** 5832/001	**Name and Address of Principal Investigator:** Dr Angel Chater
2	**Project Title:** The impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the United Kingdom	
3	**Type of Amendment/s (tick as appropriate)** ☐ Research procedure/protocol (including research instruments) ☐ Participant group ☐ Sponsorship/collaborators ☒ Extension to approval needed (extensions are given for one year) ☐ Information Sheet/s ☐ Consent form/s ☐ Other recruitment documents ☐ Principal researcher/medical supervisor* ☐ Other * *Additions to the research team other than the principal researcher, student supervisor and medical supervisor do not need to be submitted as amendments but a complete list should be available upon request.	
4	**Justification** (give the reasons why the amendment/s are needed) The study has not reached completion	
5	**Details of Amendments** (provide full details of each amendment requested, state where the changes have been made and attach all amended and new documentation) None	
6	**Ethical Considerations** (insert details of any ethical issues raised by the proposed amendment/s) None	
7	**Other Information** (provide any other information which you believe should be taken into account during ethical review of the proposed changes) None	

Declaration (to be signed by the Principal Researcher)

- I confirm that the information in this form is accurate to the best of my knowledge and I take full responsibility for it.
- I consider that it would be reasonable for the proposed amendments to be implemented.
- For student projects I confirm that my supervisor has approved my proposed modifications.

Signature:

Date: 14-12-15

FOR OFFICE USE ONLY:

Amendments to the proposed protocol have been ..approved.. by the Research Ethics Committee.

Signature of the REC Chair, Professor John Foreman

Date: 16/12/2015.

Appendix 5: Topic Guide for the Focus Groups

1. What do you think of the usual lecture-based method of teaching?
2. What are the difficulties and benefits of the traditional lecture to you?
3. What other different teaching approaches have you come across while you are doing your degree? Describe each with advantages and disadvantages to you, personally.
4. If any, what are the differences in teaching approaches between science-based subjects such as pharmacology, and pharmacy practice subjects such as therapeutics?
5. What technologies have been used so far for teaching in your MPharm degree? How do you feel about them?
6. How would you feel about introducing a teaching technique that involves pre-class preparation by viewing a recorded lecture, and participating in active learning exercises during the class time?
7. How do you think this method would help your learning?
8. How do you think this method would prepare you for assessment?
9. How do you think this method would prepare you for being a pharmacist?

Appendix 6: Information Sheet for Student Participants in Research Studies

You will be given a copy of this information sheet.

Title of Project: **The impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the United Kingdom**

This study has been approved by the UCL Research Ethics Committee (Project ID Number): 5832/001

Name Mona Almanasef

Work Address UCL School of Pharmacy

29-39 Brunswick Square

London, WC1N 1AX

Contact Details

We would like to invite you to participate in this research project.

Details of Study:

The Purpose of the study

The study will be conducted to assess the feasibility, acceptability and effectiveness of the flipped classroom teaching format on undergraduate pharmacy students in two pharmacy schools in the United Kingdom: UCL School of Pharmacy in London and the School of Pharmacy and Biomedical Sciences at Portsmouth University.

Why I have been chosen?

You have been chosen to participate in this study because you are enrolled in year four of the MPharm programme.

If I agree to participate, what it will involve

If you agree to participate, you will be asked to take part in a focus group session along with 6-11 fellow students to explore your views on the teaching approaches used in your MPharm degree. In particular, you will be asked questions about how you feel about the way you are taught and your thoughts on another method of teaching.

Participation in the study is voluntary and you may withdraw your data from the project at any time up until it is transcribed for use in the final report. We will treat any information you provide with anonymity and strict confidentiality. For the research purpose, the focus group session will be audio recorded and will be only accessible to the research team. A recorded focus group session will be transcribed (written up) and the tape will then be wiped clear. The information you provide will not be disclosed in any way that might identify you or that might enable you to be traced. Pseudonyms (another name) will be given for all participants when transcribing the focus group session. Your opinion, a decision to withdraw at any time, or decision not to take part, will not affect the standard of education you receive. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form.

Who should I contact?

If you have any question about the study, please feel free to contact Mona Almanasef on:

Please discuss the information above with others if you wish or ask us if there is anything that is not clear or if you would like more information.

It is up to you to decide whether to take part or not; choosing not to take part will not disadvantage you in any way. If you do decide to take part you are still free to withdraw at any time and without giving a reason.

All data will be collected and stored in accordance with the Data Protection Act 1998.

Appendix 7: Informed Consent Form for Student Participants in Research Studies

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Project: **The impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the United Kingdom**

This study has been approved by the UCL Research Ethics Committee (Project ID Number): 5832/001

Thank you for your interest in taking part in this research. Before you agree to take part, the person organising the research must explain the project to you.

If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you to decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

Participant's Statement

I

- have read the notes written above and the Information Sheet, and understand what the study involves.
- understand that if I decide at any time that I no longer wish to take part in this project, I can notify the researchers involved and withdraw immediately.
- consent to the processing of my personal information for the purposes of this research study.
- understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.
- agree that the research project named above has been explained to me to my satisfaction and I agree to take part in this study.

- understand that my participation in the focus group will be taped and I consent to use this material as part of the project.
- understand that the information I have submitted will be published as a report and I will be sent a copy. Confidentiality and anonymity will be maintained and it will not be possible to identify me from any publications.
- agree that my non-personal research data may be used by others for future research. I am assured that the confidentiality of my personal data will be upheld through the removal of identifiers.

Signed: Date:

Appendix 8: The traditional lecture questionnaire

Survey on Teaching Sessions

Please can you provide some feedback on the teaching session. Please take a few minutes to fill in the survey below. We value your opinion and would appreciate your feedback.

Completion and return of the survey will be consent to having this data analysed anonymously for research purposes. Data will not be used in a manner which would allow identification of your individual responses. Please be as honest as possible in answering the questions.

I. Student ID number: _____

II. Demographics

1. What is your gender
    a. Male
    b. Female

2. What is your age (In years) _____

3. What is your first language?
    a. English
    b. Not English (please state _____)

III. For each statement, think about the session you have just attended, please tick the box which matches your opinion most closely.

No	Question	Strongly Disagree	Disagree	Agree	Strongly Agree
1	The lecturer considered my feelings				

No	Question	Strongly Disagree	Disagree	Agree	Strongly Agree
2	The lecturer talked rather than providing an opportunity to ask questions				
3	The lecture was made up of students who do not know each other well				
4	I look forward to coming to similar lectures				
5	I knew exactly what was going to happen in our lecture				
6	New ideas were tried out in this lecture				
7	All students in the lecture were expected to do the same work, in the same way and in the same time				
8	The lecturer talked individually with me				
9	I put effort into what I did in the lecture				
10	I know most students in the lecture by their first names				
11	I am dissatisfied with what was done in the lecture				
12	Getting a certain amount of work done was important in this lecture				
13	New and different ways of teaching were seldom used in this lecture				
14	The pace of the lecture met my needs				
15	The lecturer went out of his/ her way to help me				
16	I “clockwatched” in this lecture				

No	Question	Strongly Disagree	Disagree	Agree	Strongly Agree
17	Friendships were made with other students in this lecture				
18	After the lecture, I had a sense of satisfaction				
19	I was daydreaming in this lecture rather than concentrating				
20	The lecturer thought up innovative activities for me to do				
21	I had a say in how the lecture time was spent				
22	The lecturer helped me when I was having trouble with the work				
23	In this lecture, I paid attention to what others were saying				
24	We didn't have much chance to help each other in this lecture				
25	The lecture was a waste of time				
26	This was a disorganised lecture				
27	Teaching approaches in this lecture were characterised by innovation				
28	I was allowed to choose activities and how I would work				
29	The lecturer seldom moved around the lecture theatre to talk to me				
30	I seldom presented my work to the class				
31	The lecture was boring				

No	Question	Strongly Disagree	Disagree	Agree	Strongly Agree
32	Lecture assignments were clear so I knew what to do				
33	Teaching approaches in this lecture were characterised by variety				
34	Teaching approaches allowed me to proceed at my own pace				
35	The lecturer was not interested in my problems				
36	There were opportunities for me to express my opinion in this lecture				
37	In this lecture, I had the chance to get to know my classmates well				
38	I enjoyed going to this lecture				
39	This lecture did not start on time				
40	The lecturer thought of unusual class activities				
41	There is little opportunity for me to pursue particular interest in this subject				
42	The lecturer was unfriendly and inconsiderate towards me				
43	The lecturer dominated the discussion during the lecture				
44	In this lecture, I was not very interested in getting to know other students				
45	The lecture was interesting				
46	Activities in this lecture were clearly and carefully planned				

No	Question	Strongly Disagree	Disagree	Agree	Strongly Agree
47	It was the lecturer who decided what would be done in our lecture				

IV. Overall session rating

No	Question	Excellent	Very good	Good	Fair	Poor
1	What is your overall rating of the teaching format used?					

V. The Kolb Learning Style Inventory

The Kolb Learning Style Inventory has been removed from the thesis to adhere to the conditional agreement of the copyright owner.

Appendix 9: The flipped classroom questionnaire

Survey on Teaching Sessions

Please can you provide some feedback on the teaching session. Please take a few minutes to fill in the survey below. We value your opinion and would appreciate your feedback.

Completion and return of the survey will be consent to having this data analysed anonymously for research purposes. Data will not be used in a manner which would allow identification of your individual responses. Please be as honest as possible in answering the questions.

I. Student ID number: _____

II. Demographics

4. What is your gender
    c. Male
    d. Female

5. What is your age (In years) _____

6. What is your first language?
    c. English
    d. Not English (please state _____)

III. Engagement with Pre-lecture materials

1. Did you do any of the pre-work?
    a. Yes
    b. No GO TO SECTION IV

2. What assigned pre-lecture materials did you do? (Select all that apply)
    a. The video lecture
    b. The post-video quiz
    c. The reading materials

3. How many days prior to the lecture did you do the pre-work?
    a. 5
    b. 4
    c. 3
    d. 2
    e. 1
    f. 0 (on the day of the lecture)

4. How much time did you spend on doing the pre-work? ON AVERAGE
    _____ (In hours)

IV. For each statement, think about the session you have just attended, please tick the box which matches your opinion most closely.

No	Question	Strongly Disagree	Disagree	Agree	Strongly Agree
1	The lecturer considered my feelings				
2	The lecturer talked rather than providing an opportunity to ask questions				
3	The lecture was made up of students who do not know each other well				

No	Question	Strongly Disagree	Disagree	Agree	Strongly Agree
4	I look forward to coming to similar lectures				
5	I knew exactly what was going to happen in our lecture				
6	New ideas were tried out in this lecture				
7	All students in the lecture were expected to do the same work, in the same way and in the same time				
8	The lecturer talked individually with me				
9	I put effort into what I did in the lecture				
10	I know most students in the lecture by their first names				
11	I am dissatisfied with what was done in the lecture				
12	Getting a certain amount of work done was important in this lecture				
13	New and different ways of teaching were seldom used in this lecture				
14	The pace of the lecture met my needs				

No	Question	Strongly Disagree	Disagree	Agree	Strongly Agree
15	The lecturer went out of his/ her way to help me				
16	I “clockwatched” in this lecture				
17	Friendships were made with other students in this lecture				
18	After the lecture, I had a sense of satisfaction				
19	I was daydreaming in this lecture rather than concentrating				
20	The lecturer thought up innovative activities for me to do				
21	I had a say in how the lecture time was spent				
22	The lecturer helped me when I was having trouble with the work				
23	In this lecture, I paid attention to what others were saying				
24	We didn’t have much chance to help each other in this lecture				
25	The lecture was a waste of time				
26	This was a disorganised lecture				

No	Question	Strongly Disagree	Disagree	Agree	Strongly Agree
27	Teaching approaches in this lecture were characterised by innovation				
28	I was allowed to choose activities and how I would work				
29	The lecturer seldom moved around the lecture theatre to talk to me				
30	I seldom presented my work to the class				
31	The lecture was boring				
32	Lecture assignments were clear so I knew what to do				
33	Teaching approaches in this lecture were characterised by variety				
34	Teaching approaches allowed me to proceed at my own pace				
35	The lecturer was not interested in my problems				
36	There were opportunities for me to express my opinion in this lecture				
37	In this lecture, I had the chance to get to know my classmates well				

No	Question	Strongly Disagree	Disagree	Agree	Strongly Agree
38	I enjoyed going to this lecture				
39	This lecture did not start on time				
40	The lecturer thought of unusual class activities				
41	There is little opportunity for me to pursue particular interest in this subject				
42	The lecturer was unfriendly and inconsiderate towards me				
43	The lecturer dominated the discussion during the lecture				
44	In this lecture, I was not very interested in getting to know other students				
45	The lecture was interesting				
46	Activities in this lecture were clearly and carefully planned				
47	It was the lecturer who decided what would be done in our lecture				

V. Overall session rating

No	Question	Excellent	Very good	Good	Fair	Poor
1	What is your overall rating of the teaching format used?					

VI. The Kolb Learning Style Inventory

The Kolb Learning Style Inventory has been removed from the thesis to adhere to the conditional agreement of the copyright owner.

Appendix 10: College and University Classroom Environment Inventory (CUCEI)- Actual form

Directions

The purpose of this questionnaire is to find out your opinions about the class you are attending right *now.*

This form of the questionnaire assesses your opinion about what this class is *actually like.* Indicate your opinion about each questionnaire statement by circling:

SA if you **STRONGLY AGREE** that it describes what this class is actually like

A if you **AGREE** that it describes what this class is actually like

D if you **DISAGREE** that it describes what this class is actually like

SD if you **STRONGLY DISAGREE** that it describes what this class is actually like

1. The instructor considers students' feelings
2. The instructor talks rather than listens
3. The class is made up of individuals who don't know each other well
4. The students look forward to coming to classes
5. Students know exactly what has to be done in our class
6. New ideas are seldom tried out in this class
7. All students in the class are expected to do the same work, in the same way and in the same time
8. The instructor talks individually with students
9. Students put effort into what they do in classes
10. Each student knows the other members of the class by their first names
11. Students are dissatisfied with what is done in the class
12. Getting a certain amount of work done is important in this class
13. New and different ways of teaching are seldom used in this class
14. Students are generally allowed to work at their own pace

15. The instructor goes out of his/her way to help students
16. Students "clockwatch" in this class
17. Friendships are made among students in this class
18. After the class, the students have a sense of satisfaction
19. The group often gets sidetracked instead of sticking to the point
20. The instructor thinks up innovative activities for students to do
21. Students have a say in how class time is spent
22. The instructor helps each student who is having trouble with the work
23. Students in this class pay attention to what others are saying
24. Students don't have much chance to get to know each other in this class
25. Classes are a waste of time
26. This is a disorganised class
27. Teaching approaches in this class are characterised by innovation and variety
28. Students are allowed to choose activities and how they will work
29. The instructor seldom moves around the classroom to talk with students
30. Students seldom present their work to the class
31. It takes a long time to get to know everybody by his/her first name in this class
32. Classes are boring
33. Class assignments are clear so everyone knows what to do
34. The seating in this class is arranged in the same way each week
35. Teaching approaches allow students to proceed at their own pace.
36. The instructor isn't interested in students' problems
37. There are opportunities for students to express opinions in this class
38. Students in this class get to know each other well
39. Students enjoy going to this class
40. This class seldom starts on time
41. The instructor often thinks of unusual class activities
42. There is little opportunity for a student to pursue his/her particular interest in this class
43. The instructor is unfriendly and inconsiderate towards students
44. The instructor dominates class discussions
45. Students in this class aren't very interested in getting to know other students
46. Classes are interesting

47. Activities in this class are clearly and carefully planned
48. Students seem to do the same type of activities every class
49. It is the instructor who decides what will be done in our class

Appendix 11: Conditional Use Agreement for the Kolb Learning Style Inventory Version 3.1

HayGroup®

CONDITIONAL USE AGREEMENT

For good and valuable consideration, the receipt and legal sufficiency of which are hereby acknowledged, I hereby agree that the permission granted to me by the Hay Group ("Hay") to receive and utilize, without charge (paper version, $3 per participant fee for online version), the Kolb Learning Style Inventory Version 3.1 ("LSI")is subject to the following conditions, all of which I hereby accept and acknowledge:

1. I will utilize the LSI for research purposes only and not for commercial gain.

2. The LSI, and all derivatives thereof, is and shall remain the exclusive property of Hay; Hay shall own all right, title and interest, including, without limitation, the copyright, in and to the LSI.

3. I will not modify or create works derivative of the LSI or permit others to do so. Furthermore, I understand that I am not permitted to reproduce the LSI for inclusion in my thesis/research publication.

4. I will provide Hay with a copy of any research findings arising out of my use of the LSI and will cite Hay in any of my publications relating thereto.

5. To translate the LSI, I need specific permission from Hay. If permission is granted, I will use the translation for my research only, and I am not permitted to include this translation in my thesis/research publication.

6. Hay will have no obligation to provide me with any scoring services for my use of the LSI other than the Algorithm used to score results.

7. Hay will not be deemed to have made any representation or warranty, express or implied, in connection with the LSI, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

8. My rights under this Agreement are non-transferable and non-exclusive and will be limited to a period of two (2) years from the date of this Agreement.

9. Hay may immediately terminate this Agreement by giving written notice to me in the event I breach any of this Agreement's terms or conditions.

10. This Agreement will be construed in accordance with the laws of Massachusetts without recourse to its conflict of laws principles.

11. This Agreement may not be assigned by me without the prior written consent of Hay.

12. Failure by Hay to enforce any provisions of this Agreement will not be deemed a waiver of such provision, or any subsequent violation of the Agreement by me.

13. This is the entire agreement with Hay pertaining to my receipt and use of the LSI, and only a written amendment signed by an authorized representative of Hay can modify this Agreement.

Agreed and understood:

Mona Almanasef 14 oct 2014

Signature	Print Name	Date

Appendix 12: The Interview Guide for the Flipped Classroom Focus Group

1. Tell us your name, and tell us which area of pharmacy you want to work in after graduating.
2. Think back to when you attended the rheumatoid arthritis session delivered in a flipped classroom format, what do you think of this teaching method in comparison to your usual lectures?
3. In your own words, can you describe what happened during the flipped classroom teaching session?
4. What worked well to you in the flipped classroom session? What did not work well to you?
5. How do you feel about further use of the flipped classroom teaching method? All or just some? How much?
6. How compared with lectures do you think the flipped classroom teaching method would help your learning?
7. How compared with lectures do you think the flipped classroom teaching method would prepare you for assessment?
8. How compared with lectures do you think the flipped classroom teaching method would prepare you for being a pharmacist?
9. If you had a chance to give us advice about the way rheumatoid arthritis session was structured, what advice would you give?
10. Do you have any other thoughts or views you would like to share?

Appendix 13: Information Sheet for the Traditional Lecture Group

Information Sheet for *Student Participants* in Research Studies

You will be given a copy of this information sheet.

Title of Project: The impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the United Kingdom

This study has been approved by the UCL Research Ethics Committee (Project ID Number): 5832/001

Name Mona Almanasef

Work Address UCL School of Pharmacy

29-39 Brunswick Square

London, WC1N 1AX

Contact Details

We would like to invite you to participate in this research project.

Details of Study:

The Purpose of the study

The study will be conducted to assess the feasibility, acceptability and effectiveness of the flipped classroom teaching format on undergraduate pharmacy students in two pharmacy schools in the United Kingdom: UCL School of Pharmacy in London and the School of Pharmacy and Biomedical Sciences at Portsmouth University.

Why I have been chosen?

You have been chosen to participate in this study because you had been enrolled in the rheumatoid arthritis unit delivered by two teaching modalities: the traditional lecture-based method and the flipped classroom technique.

If I agree to participate, what it will involve

If you agree to participate, we will data collect the surveys and the formative assessment that you completed as part of the teaching exercises. Participation in the study is voluntary and you may withdraw your data from the project at any time. We will treat any information we obtain or you provide with anonymity and strict confidentiality. Your opinion, a decision to withdraw at any time, or decision not to take part, will not affect the standard of education you receive. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form.

Who should I contact?

If you have any question about the study, please feel free to contact Mona Almanasef on:

Please discuss the information above with others if you wish or ask us if there is anything that is not clear or if you would like more information.

It is up to you to decide whether to take part or not; choosing not to take part will not disadvantage you in any way. If you do decide to take part you are still free to withdraw at any time and without giving a reason.

All data will be collected and stored in accordance with the Data Protection Act 1998.

Appendix 14: Informed Consent Form for the Traditional Lecture Group

Informed Consent Form for *Student Participants* in Research Studies

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Project: The impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the United Kingdom

This study has been approved by the UCL Research Ethics Committee (Project ID Number): 5832/001

Thank you for your interest in taking part in this research. Before you agree to take part, the person organising the research must explain the project to you.

If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you to decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

Participant's Statement

I _____

- have read the notes written above and the Information Sheet, and understand what the study involves.
- understand that if I decide at any time that I no longer wish to take part in this project, I can notify the researchers involved and withdraw immediately.
- consent to the processing of my personal information for the purposes of this research study.

- understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.
- agree that the research project named above has been explained to me to my satisfaction and I agree to take part in this study.
- understand that the information I have submitted will be published as a report and I will be sent a copy. Confidentiality and anonymity will be maintained and it will not be possible to identify me from any publications.
- agree that my non-personal research data may be used by others for future research. I am assured that the confidentiality of my personal data will be upheld through the removal of identifiers.

Signed: Date:

Appendix 15: Participant Debrief Sheet for the Traditional Lecture Group

Participant Debrief Sheet

The impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the United Kingdom

Thank you for taking part in this study.

The study will be conducted to assess the feasibility, acceptability and effectiveness of the flipped classroom teaching format on undergraduate pharmacy students in two pharmacy schools in the United Kingdom: UCL School of Pharmacy in London and the School of Pharmacy and Biomedical Sciences at Portsmouth University.

We assigned potential participants into two groups: the flipped classroom group, and the lecture group. You were allocated into the lecture group. We delivered the lectures without informing you that you had been in an experiment in order to reduce bias of your learning experience, and to enable the experiment to be carried out in more natural conditions.

If you feel concerned or uncomfortable about the fact that you were deceived, you are free to withdraw your data from the study without being disadvantaged. We will treat any information you provide with anonymity and strict confidentiality.

If you have any complaints, concerns, or questions about this study, please feel free to contact, Mona Almanasef, Email:

Thanks again for helping us with this research.

Appendix 16: Information Sheet for the Flipped Classroom Group

Information Sheet for *Student Participants* in Research Studies

You will be given a copy of this information sheet.

Title of Project: The impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the United Kingdom

This study has been approved by the UCL Research Ethics Committee (Project ID Number): 5832/001

Name Mona Almanasef

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Contact Details

We would like to invite you to participate in this research project.

Details of Study:

The Purpose of the study

The study will be conducted to assess the feasibility, acceptability and effectiveness of the flipped classroom teaching format on undergraduate pharmacy students in two pharmacy schools in the United Kingdom: UCL School of Pharmacy in London and the School of Pharmacy and Biomedical Sciences at Portsmouth University.

Why I have been chosen?

You have been chosen to participate in this study because you had been enrolled in the rheumatoid arthritis unit delivered by two teaching modalities: the traditional lecture-based method and the flipped classroom technique.

If I agree to participate, what it will involve

If you agree to participate, we will data collect the surveys and the formative assessment that you completed as part of the teaching exercises. You will also be invited to take part in a focus group session to further assess your perception of the flipped classroom teaching method. Participation in the study is voluntary and you may withdraw your data from the project at any time up until it is transcribed for use in the final report. We will treat any information we obtain or you provide with anonymity and strict confidentiality. For the research purpose, the focus group session will be audio recorded and will be only accessible to the research team. A recorded focus group session will be transcribed (written up) and the tape will then be wiped clean. The information you provide will not be disclosed in any way that might identify you or that might enable you to be traced. Pseudonyms will be given for all participants when transcribing the focus group session. Your opinion, a decision to withdraw at any time, or decision not to take part, will not affect the standard of education you receive. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form.

Who should I contact?

If you have any question about the study, please feel free to contact Mona Almanasef on:

Please discuss the information above with others if you wish or ask us if there is anything that is not clear or if you would like more information.

It is up to you to decide whether to take part or not; choosing not to take part will not disadvantage you in any way. If you do decide to take part you are still free to withdraw at any time and without giving a reason.

All data will be collected and stored in accordance with the Data Protection Act 1998.

Appendix 17: Informed Consent Form for the Flipped Classroom Group

Informed Consent Form for *Student Participants* in Research Studies

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Project: The impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the United Kingdom

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Thank you for your interest in taking part in this research. Before you agree to take part, the person organising the research must explain the project to you.

If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you to decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

Participant's Statement

I _____

- have read the notes written above and the Information Sheet, and understand what the study involves.
- understand that if I decide at any time that I no longer wish to take part in this project, I can notify the researchers involved and withdraw immediately.
- consent to the processing of my personal information for the purposes of this research study.

- understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.
- agree that the research project named above has been explained to me to my satisfaction and I agree to take part in this study.
- understand that my participation in the focus group will be taped and I consent to use this material as part of the project.
- understand that the information I have submitted will be published as a report and I will be sent a copy. Confidentiality and anonymity will be maintained and it will not be possible to identify me from any publications.
- agree that my non-personal research data may be used by others for future research. I am assured that the confidentiality of my personal data will be upheld through the removal of identifiers.

Signed: Date:

Appendix 18: Participant Debrief Sheet for The Flipped Classroom Group

Participant Debrief Sheet

The impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the United Kingdom

Thank you for taking part in this study.

The study will be conducted to assess the feasibility, acceptability and effectiveness of the flipped classroom teaching format on undergraduate pharmacy students in two pharmacy schools in the United Kingdom: UCL School of Pharmacy in London and the School of Pharmacy and Biomedical Sciences at Portsmouth University.

We assigned potential participants into two groups: the flipped classroom group, and the lecture group. You were allocated into the flipped classroom group. We delivered the lectures without informing you that you had been in an experiment in order to reduce bias of your learning experience, and to enable the experiment to be carried out in more natural conditions.

If you feel concerned or uncomfortable about the fact that you were deceived, you are free to withdraw your data from the study without being disadvantaged. We will treat any information you provide with anonymity and strict confidentiality.

If you have any complaints, concerns, or questions about this study, please feel free to contact, Mona Almanasef, Email:

Thanks again for helping us with this research.

Appendix 19: Summary of Academic Contributions

Oral Presentations

- Almanasef, M., Chater, A., Portlock, J. *The Impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the UK*, PhD research day, UCL School of Pharmacy (London, United Kingdom, September 2016).

Poster Presentations

- Almanasef, M., Chater, A., Portlock, J. *The Impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the UK,* The 9th Annual International Conference of Education, Research and Innovation (Seville, Spain, November 2016).
- Almanasef, M., Chater, A., Portlock, J. *The Impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the UK*, The Manchester Pharmacy Education Conference (Manchester, United Kingdom, June 2016).
- Almanasef, M., Chater, A., Portlock, J. *The Impact of the flipped classroom instructional model on MPharm students in two pharmacy schools in the UK*, PhD research day, UCL School of Pharmacy (London, United Kingdom, April 2015).

Certificates

- European Computer Driving Licence (ECDL), United Kingdom, December 2014.
- Associate Fellow of the Higher Education Academy, United Kingdom, July 2016.

Professional/Academic Experience

- OSCE assessor at the MPharm professional skills laboratory, UCL School of Pharmacy, London, United Kingdom (2014-2017).