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**THE PARTICIPATION AND ENGAGEMENT OF YOUNG PEOPLE WITH
PHYSICS IN POST-COMPULSORY EDUCATION**

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**A portfolio submitted in partial fulfilment
of the requirements of the University of Sunderland
for the degree of Professional Doctorate**

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Introduction to the portfolio

This portfolio is presented in the form of ten distinct studies (sections) that each contribute towards the whole study. There is a final section (11) which contains supporting information. The portfolio has been produced in conjunction with the over-arching Critical Reflection Report, which contextualises the study in relation to my professional practice.

Each section can be regarded as a 'stand-alone' study, consequently there are some occasions where overlap of themes may occur in order to ensure each issue is fully addressed. Each of the sections within the portfolio has been used to inform and improve professional practice both inside and outside of my particular educational establishment. Each section has been reviewed by a member of staff from my institution (mostly senior managers, although some managers at the same professional level as myself) as well as professionals from external organisations such as the Institute of Physics, STEMNET and the Science Learning Centre.

The main objectives of the study and how they relate to the sections contained within the portfolio can be seen in Chart 1. Similarly, Chart 2 shows how the key research questions have been answered by each of the sections within the portfolio. Chart 3 shows how each of the sections have been disseminated to a wider audience, listing the range of colleagues and managers from my own organisation, as well as the range of consultants and professionals from external organisations who have so kindly reviewed and evaluated my studies.

Chart 1

The Main Objectives

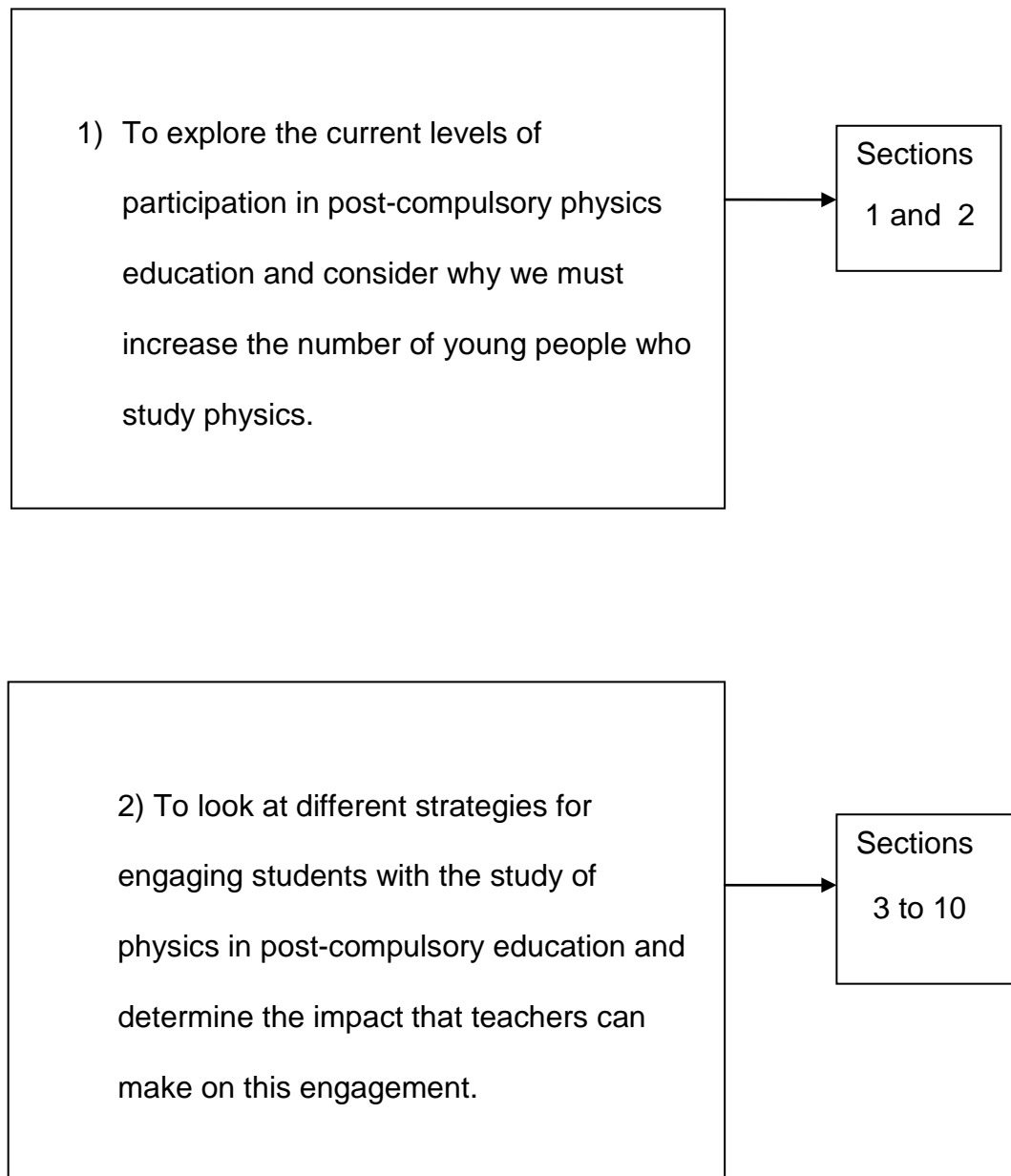


Chart 2

Key Research Questions

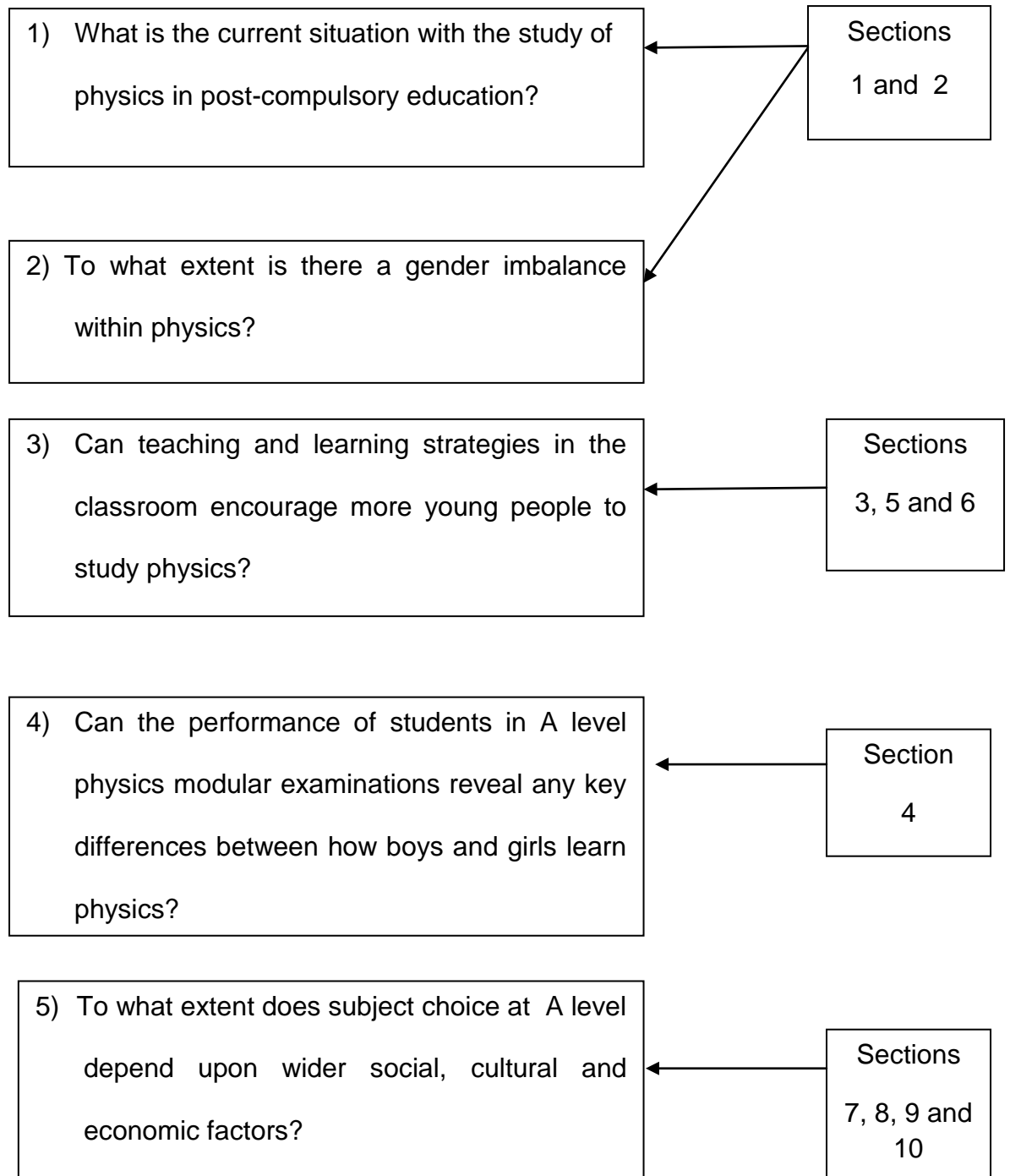


Chart 3

Dissemination of each of the ten studies

STUDY	Internal Review	External Review	Disseminated to wider audience
1	Head of Sixth Form (PhD in Education)	Consultant from the Institute of Physics (PhD in Education)	Education Department of the IOP (January 2011)
2	Head of Sixth Form (PhD in Education)	Consultant from the Institute of Physics (PhD in Education)	Education Department of the IOP (January 2011)
3	Co-ordinator of the Teaching and Learning Team	Senior Lecturer from University Education Department	College Review of Teaching and Learning strategies (TBA)
4	Curriculum Leader (PhD in Physics)	Head of Education (pre - 19), Institute of Physics (PhD in Education)	Education Department of the IOP (February 2011)
5	Director of Learning Resources	Professional Development Leader, Science Learning Centre	Presentation (June 2010) SLC website (November 2010) JISC website (March 2011)
6	Head of Academic Studies ¹	Regional Co-ordinator (STEMNET)	Science and Mathematics Team Meetings (2009 to 2011)
7	Head of Academic Studies	Lecturer in Cultural Studies, Local University (PhD in History)	Science and Mathematics Team Meetings (2009 to 2011)
8	Maths Team Leader (PhD in Astrophysics)	Senior Connexions Adviser	Forwarded to the Regional Head of the Connexions Service (January 2011)
9	Maths Team Leader (PhD in Astrophysics)	Senior Connexions Adviser	Forwarded to the Regional Head of the Connexions Service (January 2011)
10	Lecturer in Cultural Studies (PhD in History)	Logistics Consultant	Forwarded to the Regional Head of the Connexions Service (May 2011)

¹ The Head of Academic Studies at the FEC was my line manager at the time of producing the report however she has now left the college.

Evaluation of Learning Outcomes

This section will evaluate the learning outcomes of the Professional Doctorate in the context of the studies contained within this portfolio.

K1 – Deep understanding of recent developments in their profession nationally and internationally

Sections 1 and 2 of this portfolio contextualise the issues by exploring the engagement of young people with post-compulsory physics education. They are supported by recent reports into physics education and discuss the extent that local trends mirror the national trend. Over the past ten years, the number of students who study GCSE physics has increased, as well as the proportion of girls for this examination. The local data mirrors the trends of the national data. For A level physics, however, the data relating to the FEC does not mirror the national trend, and it is proving difficult to attract girls to study this subject at A level.

Sections 3, 4 and 5 of the portfolio explore issues relating to physics education within the classroom. Section 6 explores the developments of external supporting agencies. Section 7 explores the wider factors that influence subject choice outside of the classroom, such as parents, school, the media and role models. This is a particularly current issue, with the recent changes to tuition fees, which will have an impact upon students applying to university in 2012. The loss of Educational Maintenance Allowance (2011) was expected to result in a decrease of students, yet the number of students who have enrolled to study science related subjects at the FEC (both for A levels and BTEC) has increased beyond expectations, with the number of AS physics students increasing from 60 to 85 in September 2011.

The theoretical literature, which is presented as a literature review in Chapter Three of the Critical Reflection Report makes reference to other cultures with similar issues to the United Kingdom. The USA, Australia and other European countries have all produced research on physics education which are included within this study.

K2 – Deep understanding of current theoretical frameworks and approaches which have direct relevance to their own professional context

Chapter 3 of the Critical Reflection Report (the Literature Review) presents the theoretical literature that underpins each of the ten sections contained within the portfolio. Each of the studies makes relevance to theoretical literature that supports that particular section, drawing upon educational research as well as reports and papers from government and professional organisations.

Whilst the theme of this study is based around physics education, it has incorporated a wider range of educational theory including the political, economic and sociological aspects of education. During the course of my studies, I have learned of the vast political framework that shapes the fragile landscape of further education, which is far less stable or secure than the provision for compulsory education. Many of the decisions made within colleges of further education are not necessarily for the best educational reasons, but for the most financially viable outcomes.

Whilst the study has raised my awareness of the political issues that surround post-compulsory education, it has primarily been focussed upon the improvement of teaching for classroom practitioners. Students are at the heart

of the study, with the aims of increasing their enjoyment, engagement and participation with physics in post-compulsory education.

S1 – Make a significant contribution to practice within their chosen field

Throughout my career, I have worked with external organisations such as the Science Learning Centre, STEMNET and used the resources provided by the Institute of Physics. The Professional Doctorate programme has provided an opportunity for extending this from simply using the services provided by these organisations towards a more pro-active contribution.

Whilst I may not have published papers for this qualification, I have contributed to the profession in other ways, such as presentations and training sessions for colleagues at my place of work, as well as a range of other external events. I have had some of my work uploaded onto national websites and features in the local newspaper. Chart 3 within this introduction shows the range of professionals and their parent organisations who have been involved throughout this study.

The first two sections of the portfolio, as well as the report on examination performance (Section 4 of the portfolio) were sent to the Institute of Physics in London, as well as used by the consultants from the Stimulating Physics Network. Whilst the study was based in a large FEC in the north east of England, the findings can be applied to other areas of the country.

Section 3 of the portfolio was used as part of a college-wide initiative on Higher Order Thinking Skills, the results of which were to be published by the Director of Learning within the FEC. Sections 8, 9 and 10 have been shared with the local Connexions service, providing them with useful information.

Therefore my studies have been shared with a wide range of internal and external agencies, many of whom I had worked with on an informal basis, but through this programme, have had the opportunity to contribute more fully towards physics education in a wider context.

S2 – Apply theory and research methodology within the workplace, and feel comfortable integrating different approaches to solve multidisciplinary problems in a rigorous yet practical manner.

The study (as a whole) involved a mixed methods methodology, incorporating qualitative data from case studies, interviews and surveys, as well as quantitative data obtained from the analysis of numerical information. Through a variety of methods, it is possible to triangulate findings and improve reliability. In Chapter Four of the Critical Reflection Report, I refer to Brookfield's four lenses of autobiography, the students' eyes, our colleagues' eyes and the theoretical literature, which all contribute towards producing a more holistic and integrated approach in educational research. (Brookfield, 1995, p.29).

Two of the sections were largely based upon the analysis of numerical data from primary sources, neither of which had been evaluated previously. The study into examination performance (Section 4) provided key information relating to the need to improve the written communication skills of our students. The analysis of UCAS destinations (Section 8 of the portfolio) considered the whole spectrum of students within the college and their intended degree subjects. While the focus of this study was to determine the numbers of students who progressed to study science degrees at university, the findings held relevance for all disciplines within the college.

Section 1 and Section 7 involved more qualitative methods such as small focus groups and one to one interviews. Section 10 involved the use of case studies. Therefore a range of methods were used in order to triangulate information. Having the purpose of working towards a professional doctorate provided the opportunity for asking pertinent questions in the workplace.

S3 – Recognise budgetary, political, strategic, ethical and social issues when addressing issues within the workplace

The most surprising finding of this study is the extent to which political and budgetary issues underpin the whole nature of a Further Education College. Compared to compulsory state education, Further Education is not as stable or secure, with far more changes taking place on a yearly basis to suit whichever government is in power at the time. Unlike schools, each FEC operates as an independent corporation, and each FEC manages its annual budget according to their needs.

This results in each college having their own terms, conditions and salary scales, which are less favourable than for our colleagues who work in compulsory education. As each college has its own management structure, this means that career development depends upon the college, and there are not the same clear career pathways that exist in schools. Whilst many teachers are attracted towards a career in a college, as it may provide the intellectual challenge of teaching A level, science teachers often realise that they are working harder and being paid less than school teachers and consequently wish to relinquish working in a FEC. The problem of staff turnover in Further Education was raised by the Science and Innovation Investment Framework (2004).

Section 8, which analysed UCAS destinations revealed that whilst FECs have to report to government on the proportion of students applying to Higher Education, there is no requirement to evaluate what subjects are being selected. In some cases, students are encouraged to apply to university without appropriate career advice. Section 9 revealed that the Connexions Service is under political pressure to account for the status of all young people under the age of 19, whether in education, employment or training. Young people who do not fall into this category (NEETS) are provided with a range of incentives to ensure that they actively engage in some form of training.

Ethical issues are integral to all aspects of the teaching profession and particularly when conducting surveys or interviews with students. Social issues such as social class have appeared to be more important than I anticipated at the start of this study. Social class has played a part in several sections of the portfolio, such as choice of sixth form or university, the reluctance of working class students to move away from home, parental involvement in education, the different type of subjects offered at state or independent schools, as well as the fact that only middle class students from the north east of England study physics at university, as they tend to be the students who can afford to live away from home.

S4 – Reflect on their own work, and on themselves, and thus operate as a truly reflective independent practitioner

The professional doctorate study incorporates a considerable amount of reflection, both within the portfolio or the over-arching critical reflection report. Within the portfolio, each section has been shared with professionals within the FEC as well as from external agencies, thus providing a wide range of

opportunities for reflection, discussion and improvement. In the critical reflection report, I have reflected upon my career and what led me to undertake the professional doctorate qualification.

In order to fully develop my ability to reflect upon my work, I studied the recommended texts and prepared written responses to the exercises presented within the reflective practitioner module. I produced essays (for my original supervisor) on two particular topics: 'Assumptions which are significant to my professional practice' and 'Reflections of one particular period of my career which had the most influence upon my professional development'. Whilst these essays were not required for the portfolio, they encouraged me to research the theory behind reflective practice and to develop my ability to express my thoughts in a coherent and fluid manner.

S5 – Present and defend an original and coherent body of work which demonstrates, reflects upon, and evaluates the impact upon practice which they have personally made.

I have presented my findings regularly at meetings within my establishment, sharing my findings with the science team as well as colleagues from other disciplines. Each section of the portfolio has been shared with managers within the college, often several, to ensure that they are aware of my work and have no issues with sharing my findings with external agencies.

I have worked with the Science Learning Centre in Durham to produce the action research project and made a presentation of my work for the regional Teaching and Learning Coaches in June 2010. I have also made a presentation of my work at Sunderland University in February 2011. I have

worked with the Institute of Physics (Stimulating Physics) consultant to organise physics events for our partner schools.

The main impact upon professional practice is by increasing the numbers of young people who study physics at the FEC, increasing the number of girls who study physics A level, and the number of young people who progress to study physics-related degrees at university. Through my studies, I have raised awareness of the issues within my institution, with our partner schools and a range of external organisations.

On a more personal level, the impact has been an improvement in my own classroom practice, which is then shared with colleagues and is borne out by continually improving examination results.