A LEARNING ARCHITECTURE: HOW PRODUCT LIFECYCLE MANAGEMENT (PLM) DRIVES INNOVATION IN THE CURRICULUM AND PEDAGOGY OF FASHION BUSINESS

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Abstract

There is a global trend toward improving the student learning experience in higher education. Industry-oriented educational courses must also consider how to prepare graduates for their future professional practice with an awareness of holism and system thinking sustainability, tolerance of uncertainty, knowledge of relevant digital technologies and use of theory.

This study responds to these challenges and illustrates an alternative pedagogic approach for the emerging sub-discipline of fashion business. Fashion business is an important and emerging subdiscipline of fashion with limited published educational research. This subdiscipline has particular significance given the cultural importance, economic significance, ethical and environmental impact of the associated industry. The acceleration and influence of technology is significantly affecting industrial working practices through the adoption of knowledge management systems such as product life-cycle management (PLM). This study represents the first implementation of a PLM philosophy and system within an undergraduate course aligned with the retail, footwear and apparel sector.

The study aimed to employ PLM to establish a community of learning between students, educators and industry with the intention of creating a participatory learning experience that mimics current practice and supports professional identity formation rather than adding digital transformation to the curriculum. The PLM system was used to update, sequence and connect the subject- and work-based elements more coherently such that engagement in practice is a source of critical and innovative thinking empowering graduates to take the practice of fashion business forward.

This action research study involved the implementation of PLM as a way of teaching a global sourcing module in the second year of the course (cohort n=28) over a phased implementation from 2014 to 2018. Communities of practice (Wenger, 1998) is used to understand the learning design and the identity work that students engage in as they develop professionally. Data was collected from students via video and interview, from the practitioner researcher and from external stakeholders. Data from all sources were analysed collectively by using Wenger's (1998) learning architecture to establish a coding scheme.

This thesis describes how the adoption of PLM established a community of learning (CoL) through an educational partnership with the global technology company, PTC Inc. It argues that PLM is a powerful tool of collaboration between students, industry and educators and provides a robust mechanism to establish a community of learning, which also preserves the unique principles derived from design pedagogy. This thesis asserts that a design pedagogy supports students' professional development and bring coherence and relevance to the curriculum and argues for the preservation of this unique learning experience in order to support the successful transition through education and onto the workplace. Further, this thesis illustrates how the insight and energy of students and graduates, who are at the periphery of practice, have much to contribute to the development of ways of working in an industry in transition. The value of closer collaboration between industry and academia is identified and the thesis makes recommendations for ways that PLM might be developed to achieve this. The study also demonstrates the applicability and value of the methodology of action research to collaborative and change projects in higher education.

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List of abbreviations

BOL	Beginning of life
BOM	Bill of materials
COL	Community of learning
COP	Community of practice
CRM	Customer relationship management
EIM	Enterprise information management
EOL	End of life
ERP	Enterprise resource planning
ICT	Information and communications technology
KMS	Knowledge management system
LPP	Legitimate peripheral practice
MOL	Middle of life
PDM	Product data management
PLM	Product lifecycle management
RFA	Retail footwear and apparel
SCM	Supply chain management
SMAC	Social, mobile, analytics and cloud

Chapter 1 Introduction

1.1 Orientation

The business of fashion is a complex one and therefore learning to become a proficient professional within the industry is multifaceted. Fashion has significant cultural significance and economic weight as an industry. The textile and apparel sector is among the largest industries in the world; it contributes significantly to the economy of many countries, with a total end market worth over Euro 2 trillion on a global level (Walter, 2016). In its growth to become one of the world's largest consumer industries it has supported global development (Global Fashion Agenda and The Boston Consulting Group, 2017). However, the textile and apparel industry sector is challenged to address issues of environmental impact and exploitation of workers associated with this rapid development.

Fashion can be considered a subdiscipline of design (Orr and Shreeve, 2018, p. 4) with learning institutions around the world preparing graduates for careers in the international fashion industry. However, fashion only recently emerged as an academic discipline when design education was given autonomy from studies of fine art in 1960 (Coldstream, 1960, cited in McRobbie, 1998). Policy makers linked this autonomy with obligations to industry and the provision of a trained workforce, which many of those working in arts schools saw as erosion of 'artistic freedom' (Orr and Shreeve, 2018, p. 31) setting up a tension that remains today between creativity and commerciality in associated higher education courses. Some fashion academics have resisted this culture of enterprise and preserved a 'world of ideas' (Farrell, 2008, p.91 cited in Fletcher and Williams, 2013) by 'sharply differentiating fashion design from technology, production and manufacture' (McRobbie, 1998, p. 38). Consequently, there is no established core curriculum and considerable diversity in associated courses. However, the business of fashion is a manufacturing industry in the creative sector and increasingly professionals are required to connect both ends of the value chain through an understanding of production and consumption to balance commercial and financial performance (Clark, 2015). The first fashion degrees to integrate aspects of business and marketing were introduced in the early 80s in what might be called the 'new realism' (McRobbie, 1998, p. 46) in fashion education in that they prepare students for the mainstream fashion industry of the high street and set out to solve the perceived mismatch between graduate skills and the needs of industry.

In the UK there are 93 universities offering 420 fashion related degrees (Whatuni, 2019) that seek to prepare their students for roles in this complex, fast-paced and challenging creative environment. However, the dynamic nature of the industry means courses inevitably lag behind industry trends and the diversification in job roles which presents a constant challenge for educators to address (Muhammad and Ha-Brookshire, 2011). In the main, most UK fashion business undergraduate courses are offered at post – 1992 universities where students engage in contemporary business issues through problem based learning and live projects. Geographically, these courses tend to be located in London and the cities and towns of northern England and Scotland that were traditionally associated with the textile industry. At undergraduate level, UK students dominate, but courses are also attracting increasing numbers of international students. The UK students tend to be female and state school educated. Fashion business courses typically cover a broad range of areas and are frequently developed with industry and accredited by a professional body such as the Textile Institute or the Chartered Management Institute. Courses seek to provide undergraduates with a sound understanding of textile materials, garment manufacturing processes and the whole supply chain through to the consumer. This diversity reflects the broad range of graduate roles and is designed to support students to realise their explicit ambition to enter the fashion industry upon graduation. This broad and applied curriculum necessitates that a majority of teaching staff have industry experience which is supplemented with regular external speakers from industry and the opportunity to attend industry events such as trade shows.

Although fashion business courses are typically associated with the QAA Business and Management benchmark, they tend not to be located within a business school but alongside other fashion and textile design courses within a school of Art and Design. In common with other art and design education, fashion business education is typically predicated on 'learning by doing' (Dewey, 1938, cited in Van Poeck, Östman and Block, 2018) based on a curriculum of activities which employ simulation of a professional situation (Tovey, 2015). The pedagogy of design is evident in all courses though elements such as studio-based, projects/live brief, assessments containing an element of performance (Shreeve, Sims and Trowler, 2010). Fashion business courses are able to recruit high student numbers are likely to adopt the traditional lecture style teaching and place a greater emphasis on theory in order to accommodate large numbers in class. Consequently, such courses typically are a blend of the pedagogy is of design and management.

Graduates are a product of the teaching system and consequently industry-oriented educational courses must also consider how to support the development of individuals

capable of developing and extending practice. The industry is currently subject to rapid change due to increasingly volatile patterns of demand, the acceleration and influence of technology and the pressing need to deal with long-standing industry issues pertaining to unethical manufacturing. Therefore, courses must also consider how to support future professionals to become change agents and deliver solutions to enduring industry problems. The central challenge for educators is how to give students a sense of this complex landscape of practice and its histories, regimes and interconnections whilst acknowledging that practice is rapidly evolving. Whilst there is not an expectation that students must become competent in all areas of industry practice, there is a need to be knowledgeable about them and their relevance to their own future practice (Tovey, 2015).

The extant pedagogic research pertaining to fashion business in higher education outlines many challenges for the future of the discipline. This research is reviewed in chapter three, the literature review. Increasingly, researchers argue that fashion education must change in accordance with the need for graduates to become change agents and manage industry demands for global citizenship (LeHew and Meyer, 2005; Karpova, Jacobs, Lee and Andrew, 2011; Muhammad and Ha-Brookshire, 2011, p. 42); sustainability (Pasricha and Kadolph, (2009); Radclyffe-Thomas, Varley and Roncha, 2018) and knowledge of relevant digital technologies (Muhammad and Ha-Brookshire, 2011; Romeo and Lee, 2013). A pedagogic approach that encourages creativity and participation in processes is advocated to achieve these requirements in future practice (Fletcher and Williams, 2013).

1.2 Justification for the study

The fashion business sector is of great economic and cultural significance and consequently undertaking research to inform and better deliver graduates to fit into the community of professional practice is a worthy enterprise (Tovey, 2015, p. 10).

However, the retail landscape is evolving rapidly due to technology (OC&C Insight, 2016, p. 2) necessitating the development of a workforce acquainted with knowledge of relevant digital technologies and business models to improve innovation and the competitiveness of the textiles and apparel sector (Walter, 2016). Digital technologies coupled with the increasingly agentive capacity of consumers is having an effect outside of retail organisations and this disruptive impact has the potential to transform the existing industry:

Together, the collision between virtual and material fashion spaces requires a fundamental retheorisation. The emergent computer -consumer -commodity nexus is thus of fundamental importance in that it holds the potential to reshape our understandings of

organisations, consumers and the mechanisms through which fashion knowledge is generated and circulated. (Crewe, 2013, p. 761)

Crewe (2013) notes the fast pace of technological developments within fashion retail is transforming the manner in which people connect, communicate and collaborate. Previous processes and practices are proving inadequate or obsolete in the digital age of fashion retail and are being replaced by technological solutions (McCormick et al., 2014, pp. 260-264). One way that the industry is changing is through the adoption of knowledge management systems (KMS) which enable the systematic, deliberate leveraging of knowledge assets (Dalkir, 2017, p. 18). Within manufacturing industries, product life-cycle management (PLM), a KMS, is recognised as an essential enterprise-wide platform to manage the complexities of product that is created, sourced and retailed globally. The holistic approach of product life-cycle management represents a paradigm shift for retail and manufacturing companies joining up many previously separate and independent processes, disciplines, functions and applications with important consequences for business processes (Stark, 2011, p. 19). Within the industry, product life-cycle management systems (PLM) are being rapidly adopted to support a strategic transformation in two phases. Phase one or PLM 1.0 is associated with managing the product development process and phase two or PLM 2.0 integrates additional functionalities derived from SMAC (social, mobile, big data/analytics, and the cloud) technologies to incorporate the customer and extend to support the full life cycle (Saaksvuori, 2011).

As a consequence, the contemporary working environment in fashion business is becoming increasingly digitised, significantly affecting industrial working practices. This challenges vocational fashion business courses to find ways to respond so that graduates are able to work in this digitised environment.

1.3 'Living the Dream' - a vignette of the early career of a fashion business graduate

The rationale for the study is illuminated by considering a student's trajectory into the complex arena of fashion business. Box 1 is intended to illustrate both the lived experience of a typical graduate's trajectory into the industry and the role of educators supporting the transition into the workplace whilst also developing graduates who are capable of moving practice forward. This example is a synthesis that is drawn from my personal experience of managing graduates in the industry, from ten years' experience supporting undergraduates to secure placement or graduate positions and the ongoing communication with these

graduates as they become more established in their careers. Box 1 provides a vignette that reflects a student's specific and explicit ambitions to join the industry.

Within retail organizations it is the role of the buyer to ensure that the right products arrive in store at the right time and price and their performance is evaluated on sales and margin achieved. The graduate recruits joining the buying offices of large retailers and brands would not consider themselves to be in an apprenticeship but their experience of working to gain promotion closely aligns with this model given. The more formal graduate training scheme that was common a generation before are now rare. Learning to become a buyer has thereby changed from a process that was very formalised and involved regular specific training relevant to the position to one which is far more ad hoc where graduates are expected to 'hit the ground running' and take responsibility for their own learning needs. Additionally, where in the past, products were manufactured locally such that there was a good understanding of the means of textile production or garment manufacture. Access to this knowledge, through general socialisation, has diminished from the 1980s when the majority of manufacturing was offshored to the Far East. Graduates entering employment at a large retailer or brand will have undergone an arduous and multi-stage recruitment process. There are few retail buying opportunities for non-graduates. For some positions there would have been over 1000 applications for each job. The recruitment process typically starts with a CV and covering letter, online aptitude tests, a video interview and finally an assessment centre of a full day's activities culminating in a final interview. These recruitment processes are replicated across even smaller companies. Common tasks along this journey include demonstrating knowledge of the retail or brand and its competition normally presented as a SWOT analysis. The assessment day tasks will include activities to demonstrate team working and decision-making by mimicking the common trading tasks of buying team - evaluating best and worst sellers, demonstrating an awareness of trends through range building and a numeracy task. The starting salary is typically £17 -20k and the workforce is predominantly female. Buying offices are demanding places to work but most brands have a 'work hard – play hard' reward system in place with regular social activities involving free food and drink. Access to a continuous flow of product samples is seen as a perk of the job. It is important to these graduates to have a 'cool' job. The headquarters of large retailers and brands tend to be in London, manufacturing brands may still have offices in previous manufacturing cities of Leeds, Manchester and Nottingham with former catalogue companies maintaining a strong presence in the North West where there is a growing hub of pure play retailers located in Manchester. Several newer brands have remained where they originated from, for example Joules in Market Harborough, Toast in Swansea and Finisterre in St Agnes.

Figure 1.1 A typical buying office (boohoo.com, n.d)

Retailers and brands typically make an organisational division based on gender and the age of the consumer: menswear, womenswear, childrenswear and then by age (or increasingly cognitive age) within each of these main divisions. The next layer of organisation within retailers and brands is then by product category. Each division has a different style of working due to the pace of fashion in that market sector and the initial assigned division therefore becomes a specialism but graduates would be moved between product categories within this division.

The product category teams are normally located in close proximity and the working environment is a cramped office with people working at laptops surrounded by product. There are typically rows of desks, increasingly 'hot desks' but most people establish a regular place to base themselves. Proximity is a necessity in order to stay up-to-date, communicate rapidly, overhear other activities in order to consider the implication for your own role. Newcomers must quickly assimilate the interconnected organisation and learn to observe old-timers in order to learn 'how things are done around here'. The primary task initially is largely administrative and involve arranging lab dip and trim approval, chasing samples, chasing costs, chasing dates providing opportunities to interact with the wider buying team and demonstrate the required competence to take on new tasks. There are normally numerous IT systems to become familiar with. IT within the sector is generally outdated with systems that are unconnected, a source of frustration, but which form an integral part of maintaining the critical path. Access to further opportunities is largely dependent on their line manager, so it may be promoted or prevented. Each individual must manage their own professional development and raise their profile through stretch projects in order to be seen as a potential candidate for promotion.

For further accounts of working in retail buying offices: Bruce and Daly, 2006; Entwistle, 2009; Fernie, Maniatakis and Moore, 2009 and Goworek, 2010.

Box 1 Exploring the lived experience of a typical graduate's trajectory into the industry

1.4 Research Aims

This study responds to the challenges outlined above and accordingly has a set of interconnected aims. By exploring these aims in this intervention, this thesis also seeks to illustrate an alternative pedagogic approach for the emerging sub-discipline of fashion business. The first aim of this research is to employ PLM to establish a community of learning between students, educators and industry with the intention of creating a participatory learning experience that mimics current practice rather than adding digital transformation to the curriculum. The aim is to use the PLM system to update, sequence and connect the subject- and work-based elements more coherently such that engagement in practice is a source of critical and innovative thinking empowering graduates to take the practice of fashion business forward.

Wenger's (1998) communities of practice theoretical framework provided the conceptual direction of this intervention. Wenger's (1998) learning architecture is derived from his

communities of practice theory and provides a mechanism for its application within formal educational settings and is applied to analyse the teaching and learning experiences within this intervention.

This thesis adopts an action research approach and presents an example of practitioner led innovation. It adopts the term 'intervention' as an alternative term to study or project to indicate the adoption of an action research process for change where a new 'intervention' (Elliott, 1991) is designed and tested with a view to gaining insight into a specific problem. This intervention adopted the ontological approach of design pedagogy where learning is closely associated with 'becoming' to develop a forward-facing learning environment where learning is conceived as participative and engaging rather than one of passive acquisition (Sfard, 1998). Accordingly, the design to establish a collaborative learning community takes participation in meaningful activity or joint endeavour as the starting point of the considerations of how to provide an arena for effective learning and teaching to support 'becoming' a professional person. It is argued that teaching and learning expressed in terms relevant to the development and service of a future identity, is a potentially powerful concept to drive learning as it opens up trajectories of participation that place engagement in practice in the context of a valued future, as expressed by Wenger:

> *Because learning transforms who we are what we can do, it is an experience of identity. It is not just an accumulation of skills and information, but a process of becoming – to become a certain person, conversely, to avoid becoming certain person. Even the learning that we do entirely by ourselves eventually contributes to make us into a specific kind of person. We accumulate skills and information, not in the abstract as ends in themselves, but in the service of an identity. It is in that formation of an identity that learning can become a source of meaningfulness and of personal and social energy. (Wenger, 1998, p. 215)*

Design pedagogy does not to claim that curriculum content is unimportant, rather that it should not be the starting point. Further, given that creativity is very much in the forefront of current international economic news, the value of design pedagogy needs to be more widely recognised and utilized within the teaching and learning of many disciplines particularly business administration and management (Gustina and Sweet, 2014) to offer an alternative approach to the education of future professionals through considerations of how best to support students' professional identity formation rather than curriculum content to be transmitted. The focus is to facilitate the development of a mind-set capable of using

technological innovation to critique existing processes of practice and create alternatives. This ambition aligns with Guile's call for education to support 'the creation of cultures and practices in education and work, which assist people to mediate between different forms of knowledge in order to create new practices and objects …' (Guile, 2010, p. 5) rather than traditional approaches to education with an emphasis on factual knowledge.

This study is based around an intervention to integrate PLM into an undergraduate fashion business course at a UK post-92 university over a phased implementation from 2014 to 2018. This intervention was reported to be the first to embed a PLM philosophy and system within an undergraduate course aligned with the retail, footwear and apparel (RFA) sector (Ashworth, 2014). This thesis focuses on the implementation of PLM into the curriculum in 2014-15 where teaching and learning of PLM was integrated into an existing 40-credit module at intermediate level. An educational partnership with the global technology company, PTC Inc., was formed in 2014 and provided access to the industry software FlexPLM. Although, the intervention recognises the strategically transformational role of PLM within the industry, it examines how this might be adapted for higher educational contexts by foregrounding an educational approach. Accordingly, this intervention utilises PLM as the context of contemporary fashion buying practice to establish a collaborative learning environment. The intervention aims to enhance the coherence and relevance in the subject-based and work-based aspects of the curriculum, encourage engagement in practice and support the development of a professional identity. This intervention has involved working collaboratively with a range of stakeholders: the department, the course team and the student participants and various external partners, as detailed in appendix 1. The main study population (n= 28) were the 2014-15 second-year cohort of a 40 credit, compulsory global sourcing module. This module adopts an applied approach to develop commercial awareness and a multifaceted understanding of the processes involved in global sourcing of fashion and textiles and the factors that impact on these processes.

1.5 Claim for Knowledge

In summary, fashion business is in a period of rapid transformation due to increasingly volatile patterns of demand, the acceleration and influence of technology and the pressing need to deal with long-standing industry issues relating to worker exploitation and environmental impacts. Alongside these changes, technology is also significantly affecting industrial working practices through the adoption of knowledge management systems such as product life-cycle management (PLM). Industry-oriented educational courses must

consider how to respond to these challenges in order for graduates to be better prepared for their future professional practice and capable of developing practice.

The study employs an action research approach based on the intervention outlined above. Although this intervention is unique set within one undergraduate fashion business course, the shared issues and experiences have a wider relevance. The argument developed in this thesis makes a contribution to the field of pedagogy of fashion business within the UK Higher Education context. In particular, the study will argue that PLM provides a robust mechanism to change within fashion business education whilst preserving the essence of design pedagogy by establishing a learning community of practice and encouraging external stakeholder contributions. It demonstrates how students learn to appreciate the interconnected nature of the fashion supply chain and as a consequence, have a more holistic or end-to-end perspective. The thesis shows that their fresh perspective has much to contribute to the industry through process and practice innovation.

In addition, the thesis's contribution is to argue that the pedagogy of design offers a unique student experience that provides a powerful vehicle to develop fashion business practitioners who have the ability to actively contribute to the development of practice.

1.6 Research questions

The questions this thesis seeks to answer are:

1. How might PLM support the establishment of a collaborative learning environment and provide a model for teaching and learning of fashion business in higher education?

2. What changes in the learning experience occur as a result of the intervention?

a. How do students experience learning using PLM?

b. What is the contribution that novices can make to an industry in the process of transition?

3. In what ways can Wenger's (1998) communities of practice theory and learning architecture approach be applied to understand the data from this study?

1.7 Structure of the thesis

The thesis starts with a discussion, in chapter two, of the theoretical concepts applicable pertinent to the pertinent to the intervention and its design. The extant literature is

summarised in chapter three to illustrate the learning challenge first by illustrating the seismic shift in the apparel retail management practice, then a review of pedagogic research pertaining to fashion business in higher education before a further review of research in other disciplines where PLM has been integrated into higher education curriculum. Chapter four covers the rationale underpinning the methodology and addresses the approach taken to the analysis of the data. Chapters five through seven present the findings by using Wenger's (1998) learning architecture. Chapter five focuses on the learning design with chapter six building on this to illustrate how the learning design underpins the identity work that students engage in as they develop professionally, while chapter seven presents the key findings about the elements of the pedagogy that emerged from the data analysis of chapters five and six as having contributed most to participants' learning. Finally, chapter eight concludes the thesis by synthesising the findings and recommendations from the intervention, clarifying the thesis' unique contribution to knowledge and discussing the areas for further research.

Chapter 2 Framing Concepts

2.1 Chapter overview

The aim of this chapter is to explain the conceptual framework underpinning the research design of this study and its analysis. According to Maxwell (2012, p. 87) there are four main sources that can be used to construct a conceptual framework: 1) experiential knowledge 2) existing theory and research, 3) pilot studies and 4) thought experiments. The following account describes how these four sources have generated the conceptual framework.

For this study experiential knowledge is identified as an underpinning resource that has had a profound influence on the framing of this intervention and guided the research design of this study. Prior to entering education full-time in 2009 I gained extensive industry experience within the fashion industry. Coming from a background of management and supply chain efficiency I had expected my role in education to be aligned with the training that I had delivered. When I first started teaching, I fell back into teaching as I had been taught: through content-focused, traditional lectures coupled with an instructional style from experience as an industrial trainer. This was in line with the teaching and learning environment prevalent on the course but seemingly rendered the students lethargic and their learning narrowed and assessment focused. It saddened me that without a sense of purpose, confidence and dynamism they would not successfully enter or thrive in the industry. My interest in pedagogy began during a postgraduate certificate in higher education, part of the induction courses for new academics, that initiated a shift from instructional transmission.

In May 2010, whilst completing this qualification, I attended the SEDA Conference: *Communities of Learning* which was opened by Etienne Wenger. In his keynote address: *Learning in landscapes of practice: knowledgeability and identity*, delegates were encouraged to consider their various 'communities' and to recognise that a sense of identity came from belonging to these, that identity is not 'what we know' but is shaped by our participation (be it full- or non-participation) in these. Wenger then challenged delegates to rethink their assumptions of learning away from a curriculum or body of knowledge that needs to be covered, to a position where learning is considered as an interaction between community, practice, identity and meaning. This is the theory of learning that underpins the notion 'communities of practice' as shown in figure 2.1. The foregrounding of particular aspects of learning can then be used to guide pedagogical approaches (Conole, 2012, p. 20).

2.2 Communities of Practice

The communities of practice theory (Wenger, 1998) has been widely adopted to inform learning and teaching practices in higher education. Although, as a consequence of this influence, it has been critiqued as over- or superficially-used (Nicolini, 2012) it remains a useful concept (Hughes, Jewson and Unwin, 2007). As identified by Fuller (2007), this study by Wenger (1998) expands on his earlier work with Lave, that supported a shift in the conception of learning from learning as acquisition to learning as participation as illustrated in figure 2.1 with the four main aspects of learning as community (belonging), learning as identity (becoming), learning as meaning (experience)and learning as practice (doing). Accordingly, the concept of community of practice identifies two conditions central in this study that facilitate learning: curriculum and legitimate peripheral participation (Lave and Wenger, 1991, p. 93) and this learning theory has been adopted as the guiding pedagogic approach. The learning theory of communities of practice (CoP) has subsequently has provided the mechanism to develop engaging teaching and learning that makes use of my previous experience and links with industry (Conlon and Taylor, 2012; Conlon, 2013). This approach also aligns with the ongoing changes in the associated industrial sector towards increased collaboration necessitated by the shift from product push (supply) and market led (demand) supply chain strategies (Hines, 2013, p. 166; Just Style, 2017) and the extension of the value chain into co-creation with consumers (Schau, Muñiz and Arnould, 2009) and more broadly from an organisational management perspective termed ‘collaborative community’ to describe the changing nature of modern organizations (Adler and Heckscher, 2006; Amin and Roberts, 2008).

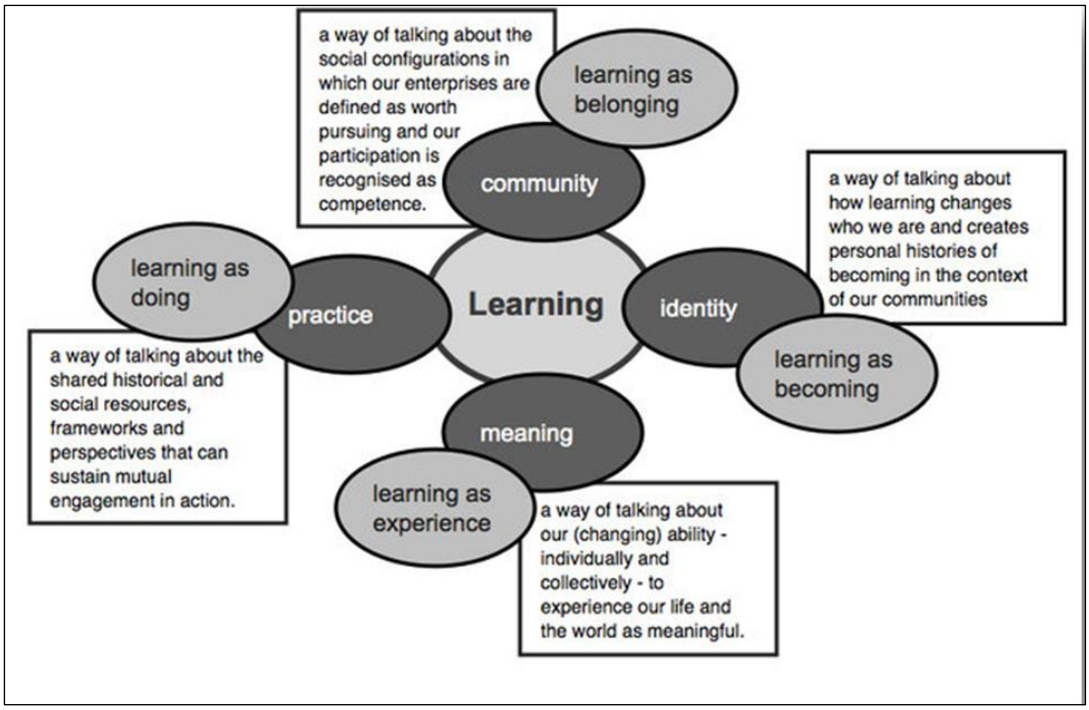


Figure 2.1 Components of a social theory of learning (Wenger 1998, p. 5)

2.2.1 Structural Qualities

The learning theory of communities of practice (Lave and Wenger, 1991; Wenger, 1998) provides a framework in this intervention. The term was first introduced in Lave and Wenger's seminal text: *Situated Learning: Legitimate Peripheral Participation* documenting the interactions between novices and experts - the process of apprenticeship, that creates a professional identity. This work was highly influential through a new conceptualization of learning conceived as situated and 'an integral part of generative social practice in the lived-in world' i.e. 'communities of practice' in sharp contrast to established behaviourist or cognitive theories (table 1.1). The notion of communities of practice (CoP) was left as a 'largely intuitive notion' (Lave and Wenger, 1991, p. 41) which permitted the term to be interpreted and applied widely. Although there is now a widespread currency of the notion within design pedagogy (Tovey, 2015, p. 2), its popularity, being a 'warmly persuasive' concept has led to indiscriminate use (Tummons, 2014, p. 133) and consequently it is important to clarify how the notion is understood and employed in this intervention.

Table 2.1.1 Established and Situated conceptualisations of learning compared (Contu and Willmott, 2003, p. 294)

Conceptualisation	Established	Situated
Learning	Cognitive-	Interactive –
	Passive – Selective	Participative – Pervasive
Form of knowledge	Canonical/Codified/	Tacit/Embedded/
	Theoretical	Practical Embedded in community and identity
	Distilled in texts and manuals	
Understanding developed	Abstract/Universal	Embodied/context – sensitive
Outcome of learning	Acquisition of informational skill	Trans(formation) of identity
Transmission	Vertical: Instruction by authorities	Horizontal: Collaboration with peers

2.2.2 Learning through legitimate peripheral participation (LPP) in the service of an identity

Communities of practice theory is a theory of learning where learning is understood as being embedded in social practice. This situated learning perspective proposed by Lave and Wenger (1991) and developed by Wenger (1998) is grounded in the supposition that learning is contextually embedded in a community of practice. The learning process by which newcomers become included in the community of practice is described as through 'legitimate peripheral participation' (LPP). As learner's engage and participate in practice they move from a position of peripheral participation to full participation and meaning is negotiated and as new meanings arise, people learn (Wenger, 1998).

Fuller (2007, p. 19) explains that for Lave and Wenger the question of what is learned by participants is answered in terms of identity formation rather than the acquisition of knowledge products. Learning is conceived as a trajectory involving processes of increasing participation in the practices of a community. Learning is in the service of an identity which is negotiated in practice. People learn (through participation) to become full members of, or knowledgeable practitioners in, the relevant communities of practice. 'Who we are' is not

the product of an internal cognitive process but instead emerges out of 'participation in an activity system by which participants share understandings concerning what they are doing and what that means in their lives and for their communities' (Lave and Wenger, 1991, p. 98).

The notion of identity is a key element of this approach where activity-based learning or 'learning to be' replaces traditional teaching methods and forms of knowledge or 'learning about'. Considering learning from the LPP perspective shifts considerations from curricula content to how to provide an appropriate context that may support opportunities for learning (Nicolini, 2012, p. 82). This intervention adopts the position that teaching and learning expressed in terms relevant to the development and service of a future identity, is a potentially powerful concept to drive learning. Through engagement in practice learning occurs that open up further trajectories of participation towards a valued future, as expressed in section 1.4.

2.2.3 Use and Limitations of Communities of Practice in Higher Education

Elements of Wenger's (1998) communities of practice framework have been used extensively to understand and explore social learning and the processes by which people come to belong to participate in a learning or workplace community. Coverage of these is beyond the scope of this thesis but interested readers are directed to the key texts illustrating the use of the CoP framework in education (Barton and Tusting, 2005), in education and professional development (Hughes, Jewson and Unwin, 2007) and online and blended Learning Research (Smith, Hayes and Shea, 2017). These texts outline some of the critical perspectives must be considered as limitations in the extent the theory can be applied.

One of the limitations raised in the extant literature relates to the associations of constancy and consensus that the phrase 'community practice' seemingly portrays and an implied isolation from external factors. It is therefore important to acknowledge the contribution of wider institutional contexts, both past and present, that influence the learning and identity of members within the community, otherwise the situation may emerge where communities of practice develop as 'self-referential founts of all relevant knowledge and learning' (Contu and Willmott, 2003, p. 292). These concerns highlight that persistence and perpetuation of the status quo that can be difficult to change within established communities of practice. Whilst Wenger describes communities of practice as 'an emergent structure… that persists

by being both perturbable and resilient' and that 'change and learning… always involve continuity as well as discontinuity' (Wenger 1998, pp. 96-97), it appears only incremental changes is likely and the structures supportive of transformational change are not well defined. In an organisational context that has been rapidly changed by digitisation, there is inadequate reference to the role of mediating artefacts to achieve change (Nicolini, 2012, p. 86) which is connected to the weakness in the theory to relate areas of practice with the wider context.

A further limitation relates to there being no explicit theory of knowledge within communities of practice and is expressed in terms of competence. However, Wenger's (1998) learning architecture approach provides a means to examine knowledge within practice and is discussed in chapter four (section 4.7.1).

2.3 Signature Pedagogies of Design Education

Pedagogy can be understood as more than the method of teaching. In practice terms it is how teaching, curriculum and assessments are made cohesive by a teacher for a particular group of students (Thomson, Hall, Jones and Green, 2012). Pedagogy puts the onus on the educator to guide the learner's journey to a particular and productive end (Laurillard, 2013, p. xvii). The principle aim of this intervention was to adopt an ontological approach to teaching and learning (Dall'Alba and Barnacle, 2007 cited in Shreeve et al., 2010, p. 128) to support students to develop both academically and professionally in order to become a critically aware practitioner in the industry capable of moving the industry forward. This aim aligns with the emphasis within design pedagogy on meaningful activity towards an endpoint supported by appropriate resources rather than curriculum content. Further, as there is no core curriculum of design (Elkin, 2001 cited in Orr and Shreeve, 2018, p. 61), course or module design must find a meaningful balance between disciplinary and work-based knowledge within the curriculum and sequence these elements so that they cohere to mutually reinforce one another to engage students (Guile, 2010, p. 156). The task of vocational pedagogy is therefore to 'face both ways' to theory and the workplace in the development of future practitioners (Barnett, 2006 cited in Wheelahan, 2012, p. 163).

The distinctive features of the pedagogies within different disciplines have been termed 'signature pedagogies' (Shulman, 2005a) as a way of understanding the characteristics of the educational process in a specific profession (Shulman, 2005b). The concept provides a means to focus on emerging professionalism and associated identity formation by asserting that knowledge is professionally grounded and situated such that signature pedagogies reinforce professional formation (Peel, 2011). The experience of a signature pedagogy

supports students' development of a professional identity though an induction (Shreeve, Sims, Trowler, 2010) that provides their 'passport' to enter the community of practice (Tovey, 2015, p. 48). Although signature pedagogies may differ across disciplines, they share three of overarching learning goals. Within professional education the signature pedagogy can be expressed in terms of three apprenticeships:

> • *a cognitive apprenticeship - learning to think like a professional,*
>
> • *practical apprenticeship - learning to perform like a professional, and*
>
> • *a moral apprenticeship - learning to think and act with integrity, in a responsible and ethical manner (Shulman, 2005 cited in Schmidt-Wilk, 2010).*

Shulman (2005a, p. 25) points out that these 'three dimensions do not receive equal attention across the professions' and it is the emphasis given to each apprenticeship that confer each discipline with its particular style.

Through application Shulman's (2005) notion of signature pedagogies provides a framework to open up discussions about pedagogy. Specifically in the discipline of fashion, it opens up considerations about the integration of theoretical knowledge in fashion business management and how the moral apprenticeship might be reinforced to support understanding of sustainability in the industry. This notion has received some attention in education literature relating to fashion business; the purpose of the studies was not to establish a single signature pedagogy but to recognise the contribution of each of the constituent parts in a composite approach. In this way those aspects that assist students to develop academically and professionally can be identified. Two management pedagogies, the use of the case study and projects, were identified by Schmidt-Wilk (2010). Whereas the signature pedagogies of design include the physical studio environment, the use of projects (often live briefs) that necessitate contextual research and the generation of material artefacts, learning through dialogue and an evaluation mechanism known as the 'crit' or other, equivalent public performance through which students are made visible and accountable to teachers and peers (Shreeve, 2015). This approach to teaching and learning in design makes deliberate attempts to replicate the professional world in order to inculcate the novice into its practices and therefore clearly embodies the model of a community a practice. The portfolio developed during the period of their undergraduate studies represents an entry ticket or passport to the community practice (Tovey, 2015, p. 48).

Traditionally, fashion and textile education has been based on current business models (LeHew and Meyer, 2005) with courses that mirror the industry, mimicking the functional silos of design, buying, sourcing and retailing and with a heavy focus on workplace-specific outcomes. However, a professional's work is characterised by conditions of inherent and unavoidable uncertainty and therefore signature pedagogies need to be updated if they are to avoid pedagogical inertia (Shulman, 2005a, p.22). Researchers have reported on the implications of this by highlighting significant neglect of important elements essential for future business success: global awareness (LeHew and Meyer, 2005); a holistic understanding of processes (Fletcher and Williams, 2013); emerging technologies (Romeo and Lee 2013) and sustainability (Pasricha and Kadolph, 2009; Radclyffe-Thomas, Varley and Roncha, 2018). When these critiques of current education are reviewed against the three constituent elements of the signature pedagogies for design there can be perceived an imbalance due to an overemphasis on the practical, learning to perform like a professional. This suggests that future educational courses would benefit from reconsidering what is ultimately desired in a professional (Shulman, 2005a, p. 24). Such a rebalancing would necessitate a greater emphasis on theory and general principles so that students are not just given access to particularised knowledge but are provided with the tools to learn how to 'think like a professional' and are provided with a holistic mind-set through systems thinking in order to develop the qualities to 'think and act with integrity' critical in an era of sustainability and industry 4.0.

2.4 The Curriculum

As described in the introduction chapter, Fashion is a 'weakly' established academic discipline (McRobbie, 1998). Within this discipline, the subject area of fashion business and management is even less established. Fashion business and management can be classified as a new 'organizational' profession (Evetts, 2006). Approaches to fashion business must consider both its cultural aspects: history, identity and its economic aspects: production, distribution and retailing in order to illuminate the connection between the production and consumption fashion (Braham, 2007). In common with other new professions, there is a certain arbitrariness to the field of knowledge that derives in part from the fact that the core knowledge base has not yet established its disciplinary foundations (Muller, 2012). Further, such interdisciplinary specialist disciplines develop in combination with professional systems resulting in a further expansion in the spectrum of possibilities (Wilson, 2010, p. 33; Tovey, 2015 p. 5). The way in which the curriculum of fashion business is conceived reflects the emerging nature of the structure of fashion business as an academic discipline with its inter-disciplinary and highly vocational core.

In established disciplines there is a strong core of theoretical knowledge and therefore disciplinary knowledge and curricular knowledge are aligned and can be conceived as the same thing (Muller 2012). Such curricula are characterised by having a conceptual coherence, this makes the task of achieving an appropriate balance of contextual and conceptual knowledge elements a more straightforward in the task of curriculum design (Muller, 2012). However, for emerging professions, disciplinary knowledge and curricular knowledge are not conceived as the same thing. Theory has come to be seen as the preserve of the academic and practices the domain of the practitioner (Wrenn and Wrenn, 2009, p. 261) and consequently vocational education courses vary widely in how they interpret their knowledge base. Such curricula are typically characterised as heavily contextual with weak disciplinary foundations. According, although all curricula have elements of both qualities: disciplinary knowledge concepts (vertically or hierarchically structured) and applied (horizontally or segmentally structured) knowledge to be learned - they differ in the assortment. Further, all curricula need to provide access to the disciplinary system of meaning as a condition for using knowledge in the particular context applications (Wheelahan, 2012) and this can be lost with too much focus on workplace specific outcomes. Vocational courses are typically validated externally by a profession or professional statutory body (Muller, 2012) and tend to seek to meet employer requirements through an emphasis on contextual knowledge. Therefore, in curriculum design or redesign within modules and courses, it is useful to consider how the knowledge content is constructed.

Clearly, educational courses must seek to develop the holistic capacity of students to facilitate and to be part of the changes needed in society and the sector. Educators must carefully consider which concepts, ideas and heuristics from disciplines, workplaces and professional knowledge(s) should be selected for inclusion in the curriculum (Guile, 2010) to ensure that students are provided with the means to support innovation in future practice. Supportive of these considerations are the four knowledge categories described by Lundvall (2016) as:

- *Know-what - knowledge about 'facts', information*
- *Know-why - knowledge that relates to principles and laws*
- *Know-how - knowledge that relates to personal knowledge and skills*

- *Know-who - knowledge relating to the ability to identify, cooperate and communicate with different kinds of people effectively (Lundvall, 2016, p. 136)*

Vocational learning tends to adopt a constructivist approach with a focus on contextually specific applications of knowledge and therefore as a clear emphasis towards 'know-how' knowledge. Lundvall (2016) highlights that know-how knowledge is shared and combined through cooperation between organisations by the means of industrial networks leading to know-who knowledge becoming increasingly important due to the trend toward interdisciplinarity in new product development. The categories of know-how and know-who knowledge relate to the practices in the workplace and the significance of these knowledge categories is expressed through continued persistence and interest in collaborative communities (Amin and Roberts, 2008; Heckscher and Adler, 2006).

Communities of practice (Wenger, 1998) is also employed by Orr and Shreeve (2018) to highlight the deliberate focus of design education to consider learning in terms of identity and participation and an emphasis on the pursuit of the novel that characterises creative pedagogy. They make use of Blacker's (1995, cited in Orr and Shreeve, 2018) different forms of knowing apparent in organizations to express the wholeness of knowing in design education as spanning explicit and tacit knowledge and the theory and practice as illustrated in figure 2.2.

Some vocational education commentators have noted that current thinking emphasises knowledge constructed as practical, interdisciplinary, informal, applied and contextual over knowledge constructed as theoretical, disciplinary, formal, foundational and generalisable (Chappell et al., 2003, p. 7 cited in Wheelahan p. 159). Taken to extreme this approach, termed the 'curriculum as practice' excludes the importance of theoretical knowledge leading to problems of relativism, where it becomes too specific and localised and then has no wider value beyond that particular context (Avis, 2007). Further, the marginalization of theoretical knowledge, the know-what and know-why, in the vocational curriculum has important consequences for innovation in associated occupations because generalizable knowledge relies on conceptual knowledge and focusing solely on practice deprives students of the theoretical knowledge that is informed by abstraction (Wheelahan, 2012). She argues (2010) that theoretical knowledge must be placed at the centre of the curriculum in all sectors of education so that students learn to distinguish theory and context in order to

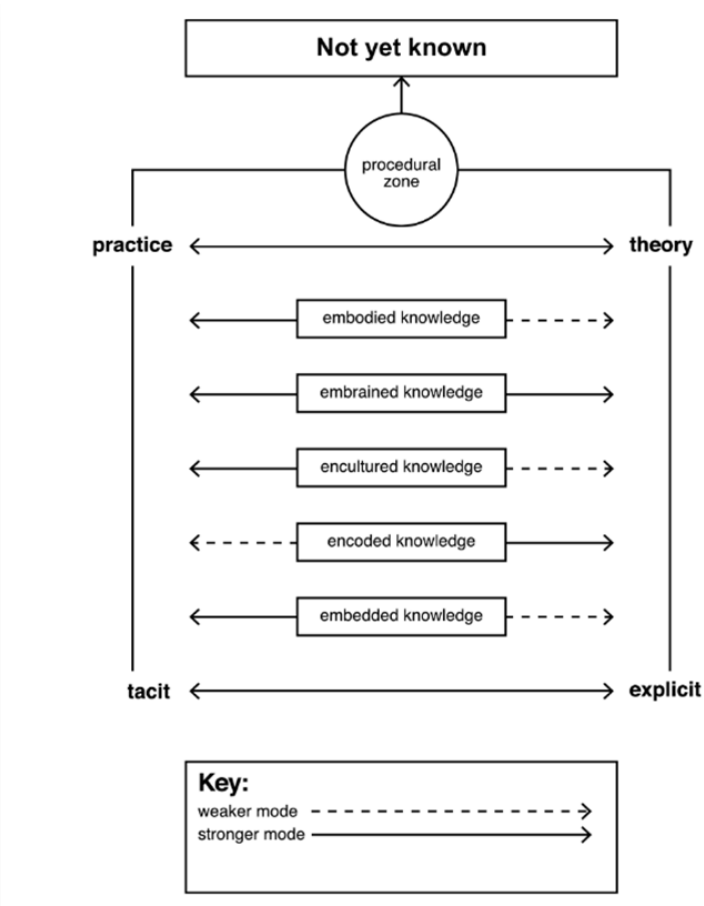


Figure 2.2 Knowledge and knowing in art and design (Orr and Shreeve, 2018, p. 35)

recognise and determine contextually appropriate applications of that theory. As Savin Baden (2009, p. 1) pointedly notes, '[H]igher education that only supplies 'training' is unlikely to equip students to work in an uncertain world'. This potentially puts the quality of learning at risk because it has the tendency to remain locked in legacy practices of today rather than seeking to develop practice.

2.5 The role of product life-cycle management (PLM) within the intervention

As outlined in chapter one, the fashion business industry associated is rapidly evolving. Academics within associated vocational education have a duty to consider how courses are updated such that 'learning by doing' (Dewey, 1938, cited in Van Poeck, Östman and Block, 2018) is up-to-date and future focused. Further, there is an additional challenge to structure the curriculum in a way that allows the forms of knowledge contained within the discipline and work- based discourses to cohere meaningfully alongside each other (Guile, 2010, p. 33

156). A foundation of factual information and knowledge organised in schema supports learning (Bransford and Brown, 2000, cited in Wilson, 2010, p. 3).

Given the strategically transformational role of PLM within the industry, this intervention was conceived around the implementation of a PLM system as a vehicle for change within fashion business education. The vision was to provide students with a participative learning environment supportive of the identity work they undertake as they develop professionally. Thus, within a framework of action research, PLM was employed to provide the context for the community of practice and thereby offer a variety of experiences associated with industrial practice. The intention was for PLM to provide the appropriate learning space to a support students' cognitive, practical and moral apprenticeship before entering the industry.

By using PLM as a representation of the landscape of practice, a means to demonstrate how the curriculum represents a body of knowledge that can be applied in practice emerges. Therefore, a mechanism to determine a congruent sequence in which codified and workplace knowledge is introduced and can be taught as mutually reinforcing (Guile, 2010 p. 156) emerges that enables abstract concepts to become a lived experience. As PLM systems have evolved, they have come to embody the evolution of practice (discussed further in chapter three) and provide a means to connect with this history of practice through participation involving the technology:

> *Becoming a full participant certainly includes engaging with the technologies of everyday practice, as well as participating in the social relations, production processes and other activities of communities of practice. But the understanding to be gained from engagement with technology can be extremely varied depending on the form of participation enabled by its use. Participation involving technologies especially significant because the artefacts used within a cultural practice carry a substantial portion of that practice's heritage… Thus, understanding the technology of practice is more than learning to use tools; it is a way to connect with the history of the practice and to participate more directly in its cultural life. (Lave and Wenger, 1991, p. 101)*

Additionally, through this representation the processes and practices are made more apparent and thereby opening them to critique, assisting students to challenge them and suggest ways to apply knowledge of relevant digital technologies to develop new practices.

2.6 Chapter summary

This chapter has discussed the interrelations between learning, teaching and the curriculum for undergraduate courses that prepare graduates for professional practice and are designed around the pedagogic principle of 'learning by doing' (Dewey, 1938, cited in Van Poeck et al., 2018). Collaborative communities and joint endeavour have been shown to provide an arena for effective learning and teaching (Tovey, 2015, p. 3). This study adopted the concepts of communities of practice (Wenger, 1998) and legitimate peripheral practice (Lave and Wenger, 1991) to guide the pedagogic approach throughout the project. Wenger's (1998) learning architecture is applied to analyse the experiences and critical reflections of devising and participating in teaching and learning at undergraduate level using a PLM platform as a vehicle to establish a community of practice. The design focused on providing participants varied opportunities for multiple modes of belonging within a community of learning thereby increasing understandings of practice and a sense of identity in relation to this practice. Wenger's (1998) learning architecture helps to highlight the design considerations - the curriculum, the environment, the people, etc. that support the students' participation in the community practice; this approach is discussed specifically in section 4.7.1 before reporting on the findings in chapters five through seven.

These elements presented here combine to form a conceptual framework that provides a reference for the aim of the research, the formulation of the research questions (Berman and Smyth, 2015) as well as direction for the research design and the accompanying fieldwork (Leshem and Trafford, 2007).

Chapter 3 Literature Review

3.1 Chapter overview

Chapter one introduced the many challenges of apparel retail management, the rapid change and the acceleration in the influence of technology which will be reviewed in more detail in this chapter. Chapter one also introduced the argument for an action research study based on an intervention which was about adopting PLM into an undergraduate fashion business course with the aim of establishing a community of learning to support students' professional development and bring coherence and relevance to the curriculum. The aim of the intervention is to offer a new approach to the pedagogy of fashion business.

Chapter two identified the key concepts that frame and underpin this educational intervention and concluded with the significance of the pedagogy of design in supporting active and collaborative learning of theory and practice. It introduced from the learning theory of community of practice two conditions that facilitate learning: curriculum and legitimate peripheral participation (Lave and Wenger, 1991, p. 93).

This chapter will examine the gap that the study aimed to fill in relation to significant and critical role in improving competitiveness and innovation in the sector through the development of graduates acquainted with new technologies and business models and these themes are developed in this chapter drawing on the extant literature.

This chapter builds on a systematic review of the literature of PLM's adoption within the fashion and retail sector was conducted (Conlon, 2019a) and is summarised in section 3.3.1. The main contribution of this paper was to provide a comprehensive review of the 26 peer-reviewed journal publications on PLM in the fashion retail sector. The review revealed that within the fashion retail, PLM is at the junction of PLM 1.0 mainstream adoption and the potential of PLM 2.0 becoming more apparent, where PLM 1.0 is delivering operational benefits in product development and PLM 2.0 offering a means to derive further benefits through the integration of SMAC (social, mobile, big data/analytics, and the cloud) technologies (Saaksvuori, 2011). The paper argued that in order to manage this next era where SMAC technologies provide opportunities for doing business differently, businesses must develop their own 'next practices'. This intervention study takes up the challenge identified in this scoping study to explore the contribution of graduates to an industry in transition and this is discussed specifically in chapter seven (section 7.5).

This chapter illustrates the challenge to curriculum content and teaching students how to apply their knowledge in the context of the industry more specifically. This intervention recognises the strategically transformational role of PLM within the industry and sought to understand how might this be adapted for higher educational contexts while foregrounding an educational approach as opposed to seeking commercial benefits. The first section, section 3.2, illustrates the seismic shift in the apparel retail management practice to illuminate the learning challenge of associated undergraduate courses, reviews the extant pedagogic research of others working within fashion business higher education and introduces the buying cycle as a core concept within the discipline. Section 3.3 then provides an overview of the origins of PLM, its current adoption and application within the sector before indicating its future commercial potential in order to better understand the context for associated graduate careers. This section also reviews where PLM has been integrated into higher education curriculum within other disciplines (mainly within engineering) in order to benefit from insights from other researchers. It is then argued that these themes require a new approach to fashion business education.

3.2 The Complexity within the Business of Fashion

3.2.1 Industry overview

> *Study of the fashion system is a hybrid subject. Loosely defined as the interrelationship between highly fragmented forms of production and equally diverse and often volatile patterns of demand, the subject incorporates the dual concepts of fashion: as a cultural phenomenon and as an aspect of manufacturing with the accent on production technology (Fine, Fine and Leopold, 1993, p. 93).*

As introduced in chapter one and summarised by this quotation, the business of fashion is a complex one. In an increasingly interconnected world, enabled by technology and the liberalisation of international trade, companies operate in many countries with both suppliers and customers around the world (Karpova, Jacobs, Lee and Andrew, 2011, p. 299). This is especially the case for the apparel industry, which is considered one of the most globalized sectors (Birnbaum, 2005; Dickenson, 1999) requiring the discipline to be compelled to prepare students to be industry-ready in the future (Ha-Brookshire, 2015, p. 10).

Since the 80s, mainstream clothing production has tended to be outsourced to low-wage countries adding another layer of complexity to the system of production. This shift in the

world market fundamentally changed business activities within the industry with the contemporary apparel industry now being the most globalised of all (Ha-Brookshire, 2015, p. 2). This shift to global apparel manufacturing resulted from policies of trade liberalisation and was facilitated by emerging information and communication technology (ICT). The complexity of the value chain of fashion and textiles production that must be understood by industry professionals working within global buying teams is illustrated in figure 3.1 and extends from fibre through manufacturing (thread, fabric, finished fabric, product) and retail to use and finally to disposal or recycling. Each part of the industry has its own history and regimes which need to be appreciated.

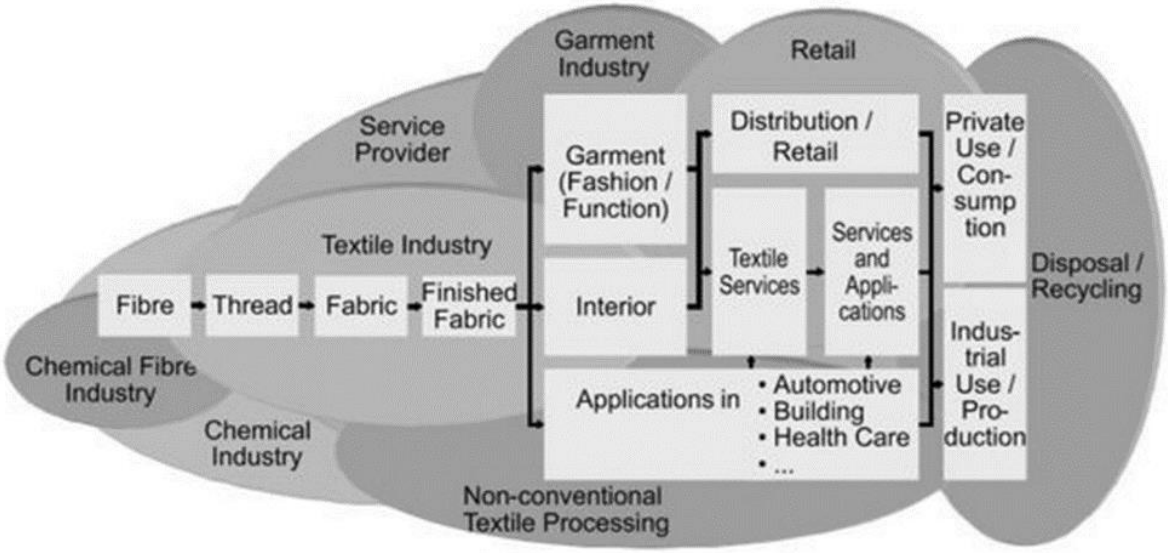


Figure 3.1 Complexity of the Textile world (Fischer and Rehm, 2005 cited in Walter, Kartsounis and Carosia, 2009)

The apparel industry within this textile world can be further sub-divided into four main sectors (Frazier and Cheek, 2005) as depicted in table 3.1. Although the table makes it appear that functions can be categorised in a clear-cut way, this in an over-simplification and inadequately illustrates the interconnectedness of the industry. Although there is certainly a resonance in this categorisation it is a historic legacy, such functional silos are being dismantled; the lived experience of the industry is more complex and requires communication and close collaboration between functions. Large retailers and brands manufacture through a network of contractors and subcontractors which further conceals the processes of textile and clothing production. Thus, although fashion business management courses are most closely associated with the retail sector there is close association with all sectors.

Table 3.1.1 The Fashion Industry Sectors and Functions (Frazier and Cheek, 2005)

Sector	Functions
Primary	Fibre/textile development Design Dye/print/finish conversion
Secondary	Design Production/manufacturing Sales/marketing
Retail	Buying/merchandising Management Sales promotion/fashion direction
Auxiliary	Advertising/publicity Buying offices Fashion publications Trade associations

3.2.2 The learning challenge of Fashion Business Education

The central challenge of fashion business education is how to give students a sense of this complex landscape of practice and its histories and interconnections whilst acknowledging that practice is rapidly evolving. The complexity of the retail apparel value chain is depicted in figure 3.2 illustrating how within the traditional product development process, there are numerous points of communication with limited process visibility. Traditional processes inadequately address the collaborative and creative nature of the industry, leading to multiple versions of a product, needless duplication of effort, and all an overall lack of control of the process.

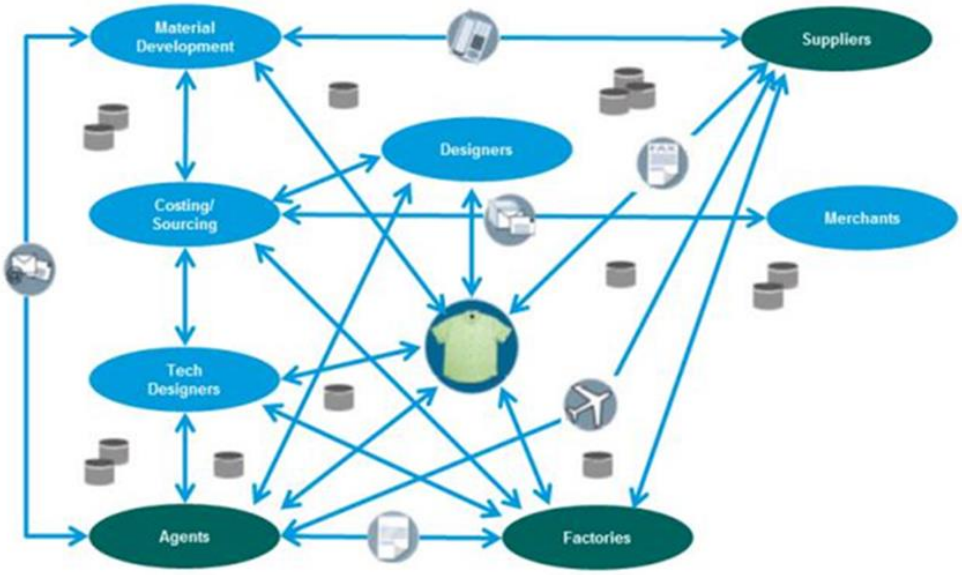


Figure 3.2 The complexity of the retail apparel value chain (PTC.com, n.d.)

By definition, industry – oriented educational courses must consider how to evolve in response to industry trends around the themes of globalisation, sustainability and technology. The lack of a learning aid to communicate to students the holistic nature of the industry and facilitates the complex process of integrating subject matter is identified as an issue (Ogle and Fiore, 2000). Further, a shift from function and focus on existing theoretical business models to participation in process and action is encouraged (Fletcher and Williams, 2013) to provide students with the ability to combine know what and know how knowledge in order to make professional decisions (Fletcher and Williams, 2013). There is a call for future industry professionals to become change agents and manage industry demands for global citizenship (LeHew and Meyer, 2005; Karpova, Jacobs, Lee and Andrew, 2011), sustainability (Pasricha and Kadolph, (2009); Radclyffe-Thomas, Varley and Roncha,2018) and technology (Muhammad and Ha-Brookshire, 2011; Romeo and Lee, 2013).

The traditional view of knowledge flow is from the centre to the periphery (Wenger-Trayner, Fenton-O'Creevy, Hutchinson, Kubiak and Wenger-Trayner, 2014, p. 16) and this view is replicated in traditional teaching. This intervention adopts an alternative perspective, where those at the periphery of practice are seen to offer a valuable, fresh perspective that can be brought to bear in times of significant change. Consequently, the study examines the transition of students from education into the workplace to better support their professional development capable of helping businesses realise exciting new opportunities and a more democratic and sustainable industry.

3.2.3 The Buying Cycle

A core concept in learning the processes of apparel product development and production within fashion courses is known as the buying cycle. The buying cycle is the term used by many UK retailers to describe the key events in the standard design and the production processes of range development within a trading period (Goworek and McGoldrick, 2015). Traditionally, within one year there were two main trading periods with new product ranges being developed for spring / summer and for autumn / winter. This product development process is modelled in a linear fashion within associated academic textbooks. This is illustrated in figure 3.3: a summary of how 'the buying cycle' is depicted within conventional fashion education texts. The process is presented with a clear start point of initial research (market, trends, materials) from which the range is developed and confirmed before manufacture and retail. Each stage of global product development and manufacturing process involves collaborative decision making between technical, managerial and creative professionals. Although different models may give a different emphasis each function within the process the overall impression is one of the straightforward process (Armstrong and Lehew, 2011, p. 38).

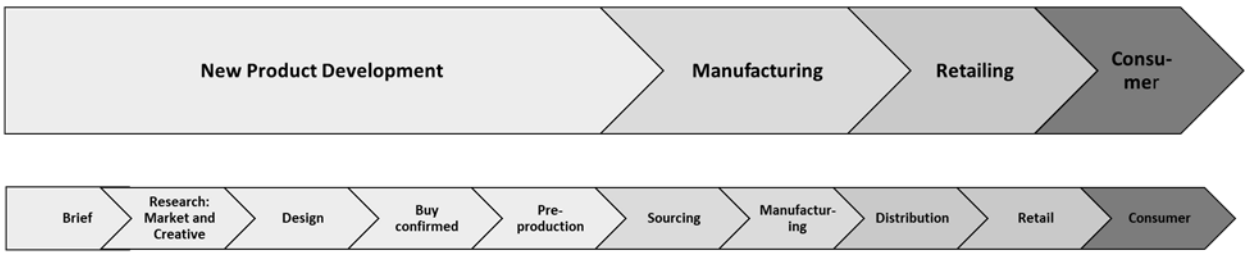


Figure 3.3 A summary of how 'the buying cycle' is depicted within conventional fashion education texts based on the processes outlined by d'Avolio et al., 2015; Armstrong et al., 2011; Jones, 2005; Burke, 2008; Matharu, 2010 and McKelvey and Munslow, 2003.

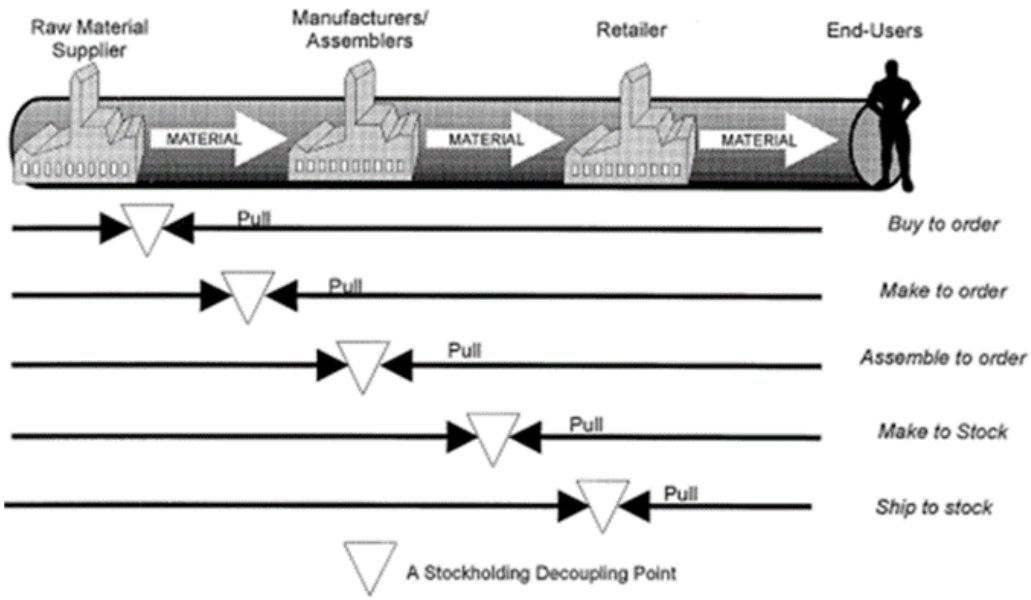


Figure 3.4 Combination of Push-Pull in Supply Chain Strategies (Naylor, Naim and Berry, 1999).

The process also depicts what is known as push manufacturing or make-to-stock as shown in figure 3.3. The process starts with an analysis of consumer needs and trends, current events, and previous sales which is then translated into a product range that is negotiated with suppliers in terms of cost and delivery, supported by technical and sourcing specialists. Completed orders are shipped to distribution centres and then to retail stores. Push manufacturing is thus based on forecasted demand. Once the product is in store, sales figures are monitored closely in order to react to changes in demand with cancellations or repeat orders. A decline in sales against the forecast results in residual stocks and loss of profit margin. Any existing stock that does not sell well is marked down in price to encourage sales. Forecasting is, however, notoriously inaccurate in fashion (Hines, 2013, p. 83) and the push supply chain strategy is therefore suitable for basic, high-volume, low-cost products with moderate demand uncertainty. Although it is possible to respond to an increase in demand this must be carefully considered as it relies on securing manufacturing capacity and faster transportation methods which are costlier thereby eroding profit margins. So, although in the past the apparel industry has been categorized as a predominantly push model, the volatile nature of the demand for fashion products has resulted in alternative approaches to supply chain management being employed.

Competitiveness was previously based on achieving high volumes at low cost; however, cost control and efficiency have now become standard. The retail landscape is evolving rapidly due to technology (OC&C Insight,2016, p.2). Today's success is determined by the ability to

be flexible and responsive to consumer demand (Christopher et al., 2004); with flexibility meaning being able to alter production quantities, styles, sizes and colours in line with market demand and responsive meaning that the entire supply chain is aligned to adjust to the requirements of the market (Hines, 2013, p. 87). Such strategies to supply chain management are known as Quick Response (QR) or the pull-model of supply, which relies on all parties in the supply chain using consumer demand information. Each interaction between the consumer and technology also provides an opportunity to collect data and this change has been described as from 'transmit to receive' mode of the retail environment (Jong, 2017, p. 1) where data may be used to inform previously intuitive decisions. In an increasingly interconnected world, companies not only have suppliers and customers around the world, they also operate in many countries (Karpova and Jacobs, 2011, p. 299). In this new era, remaining competitive increasingly relies on the ability to be responsive to consumer demand through product and process innovation based on a deep understanding of customers coupled with robust supply chain relationships throughout the entire supply chain. The various approaches to supply chain management from push to pull production is depicted in figure 3.3 (Naylor, Naim and Berry, 1999). There are advantages and disadvantages to each approach resulting in hybrid versions of the two systems. The pull-system strategy has the disadvantage that it does not benefit from economies of scale achievable with the push-system approach. Therefore, all three kinds of supply chain management (push, pull and hybrid) co-exist in the apparel industry as the appropriate supply chain strategy depends the company's strategic approach to its market, customers and products.

3.3 Product Lifecycle Management (PLM)

3.3.1 PLM in Industry

The PLM concept can trace its origins back to the development of computer aided design (CAD) tools that emerged in manufacturing industries in the 1980s. As global sourcing of production became established, the predecessor to PLM, product data management (PDM) emerged from the need to share design concepts through globally dispersed supply chains. PDM allowed for the establishment of procedures to manage product development processes and associated collaborative workflows which could then be automated. Simultaneously other new technological tools designed to streamline and support operations were being introduced alongside the computer-aided design and manufacturing systems of CAD/CAM and PDM systems such as Enterprise Resource Planning (ERP) and Customer Relationship

Management (CRM) (Ameri and Dutta, 2005). ERP was first to become established as an essential business tool that is used across organisations to manage financial transactions and planning. PLM emerged in the 1990s as a strategic business model representing 'an integrated approach for the creation, organisation, and management of product related knowledge across an enterprise, its network of suppliers, and its partners…' (Cantamessa, Montagna and Neirotti, 2012, p. 193). Whereas ERP systems remain dominant within the fashion industry given its focus on delivery (Terzi, Bouras, Dutta, Garetti and Kiritsis, 2010), in design-centric engineering industries such as automotive and aeronautic manufacture, PLM has reached a greater level of adoption through a recognition that future long-term competitive advantage will be derived from innovation in products and services. Both systems share the bill-of-materials (BOM) and product data held within a PLM system can be transferred into an ERP system for sourcing and execution. There is now a growing recognition of the need to integrate and consolidate enterprise systems such as PLM and ERP systems to provide accurate data to support agile decision processes (Shilovitsky, 2017). Unlike other software applications, PLM is grounded in the philosophy of connectivity of knowledge (Terzi et al., 2010) and now provides the foundation on which other system applications operate through a process of ongoing integration with other modern technologies in the design and production areas such as 3-D simulation and 3-D printing.

Within manufacturing industries, PLM is now recognised as an essential enterprise-wide platform to manage the complexities of product that is created, sourced and retailed globally. The holistic approach of product life-cycle management represents a paradigm shift within the retail and manufacturing companies joining up many previously separate and independent processes, disciplines, functions and applications with important consequences for business processes (Stark, 2011, p. 19). The adoption and integration of core functions of PLM provides organisation with access to best practices for process standardisation, reduction in time to market, quality improvement and cost reduction (Ameri and Dutta,2005; Stark, 2011). PLM enables the establishment of a sustainable, product – related, corporate strategy for competitiveness (Terzi et al., 2010) but this is far from realized within apparel retail management.

In comparison to the traditional PLM investors in automotive, aerospace and electronic manufacturing, the RFA sector has been described as a late adopter (AMR Research Inc., 2007). However, there is an increasing sense of urgency towards PLM adoption, driving growth in the retail and apparel PLM market (Transparency Market Research, 2015) with RFA retail brands and manufacturers investing in product lifecycle management (PLM) to guide their strategic efforts in addressing the challenges and opportunities inherent in the

modern industry (Just Style, n.d.) recognising the discipline of PLM can drive operational excellence and support planned future business transformation (Suleski and Toncheva, 2016). Cloud-PLM platforms now provide organisations with the opportunity to digitally reconfigure business processes rapidly with modular license options also making it more viable for small and medium sized enterprises (SMEs) (Silventoinen, Pels, Kärkkäinen and Lampela, 2011).

PLM is at an interesting phase with the PLM acronym playing a 'holistic' role (Stark, 2005), acting as a hub connecting intangible asset information (i.e. virtual products of design and analysis activities) to physical assets information managed across enterprise systems such as ERP and CRM (Swink, 2006). The trajectory of PLM system's increased scope towards acting as Enterprise Information Management (EIM) tools is indicated in the collaboratively derived, comprehensive definition of PLM by Corallo et al.:

> *…a strategic business approach that supports all the phases of product lifecycle, from concept to disposal, providing a unique and timed product data source. Integrating people, processes, and technologies and assuring information consistency, traceability, and long-term archiving, PLM enables organizations to collaborate within and across the extended enterprise. (Corallo et al., 2013, p. 6)*

PLM is currently in the process of evolution, away from a monolithic on-premise installation to hosted (cloud) systems with an open additive 'platform' approach to system architecture increasingly capable of connecting technologies from multiple providers supporting the process of digital transformation of the organization (CIMdata, 2015). The ongoing expansion in the role of PLM in digital asset management (Romeo and Lee, 2013), indicates that PLM could support the wider digital transformation though developing understandings of the potential of these emerging technologies (Fielding, McCardle, Eynard, Hartman and Fraser, 2014). Key enabling Web 2.0 technologies are increasingly provided in PLM solutions affording real-time collaboration features for globally distributed teams. The use of Web 2.0 tools within companies is termed Enterprise 2.0 (McAfee, 2006) and therefore the moniker 'PLM 2.0' has emerged to differentiate connected PLM from traditional PLM 1.0. As illustrated in figure 3.4 new processes and practices will yield a more collaborative effort between design, manufacturing, the supply chain and the customer.

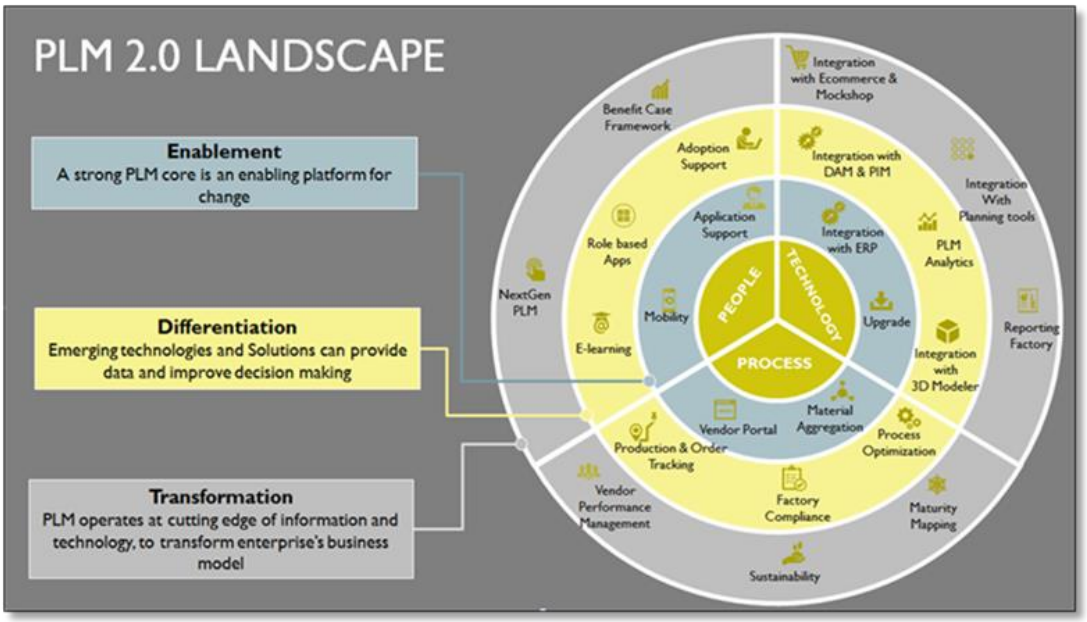


Figure 3.5 The PLM 2.0 landscape: enablement, differentiation and transformation (Conlon and Narayanaswamy, 2017)

When the social and cultural aspects are judged as important as technological aspects within an implementation, PLM is understood as a management approach rather than a software. In these applications, PLM can be considered a 'culture generating solution' (d'Avolio, Bandinelli and Rinaldi, 2015, p. 111) that offer a mechanism to drive organisational excellence and to address the challenges of the industry. PLM enables companies to become more innovative in their approach to challenges, such as product customisation, traceability, growing competition, short product development and delivery times, localisation, tight regulations, and legislation (Saaksvuori and Immonen, 2008; Stark, 2011). Implementation of PLM is frequently utilised with the aim of achieving organisational change (Garetti, Terzi, Bertacci and Brianza, 2005). In practice, some companies struggle with implementing PLM (Batenburg, Helms and Versendaal, 2006; Silventoinen et al., 2011) due to the magnitude of this transformation. PLM implementation requires a fundamental rethink of business processes, beyond defining roles and computerising existing processes, to leverage the power of technology to meet the challenges and opportunities in the sector. However, PLM must not be considered a turnkey solution as the process of implementation will be individual to each business and its forward strategy (Schuh, Rozenfeld, Assmus and Zancul, 2008; Segonds, Mantelet, Nelson and Gaillard, 2015; Vezzetti, Alemanni and Morelli, 2015).

The function that PLM is currently providing is through supporting the processes and infrastructure of collaborative product design and supply chain innovation (Swink, 2015).

Although the notion of 'best practice' suggests an ease of transferability and applicability that is contested (Harrington, 2004) where procedures are poorly established there is a clear potential for improvement by reviewing existing process models. Process improvement through PLM implementation is an open-ended process as illustrated in figure 3.5.

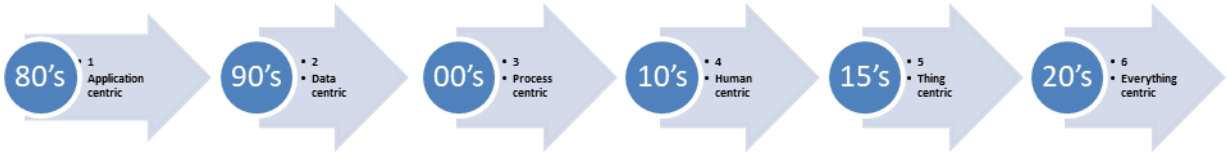


Figure 3.6 Generations of enterprise information systems (adapted from Panetto et al, 2015)

A clear understanding of PLM in terms of definition, components, functionalities, scope and its relative positioning within the organisation (Ameri and Dutta, 2005) is required by both users and system developers if the true benefits of PLM solutions are to be gained yet there is limited industry practitioner understanding of PLM (Easters, 2012b). This is not aided by the plethora of promotional promises used in marketing of software vendor's such that PLM is commonly viewed as today's buzzword for the latest industry software rather than a strategic business approach. Unfortunately, therefore 'too few have a holistic understanding of PLM as a way to operate in product development and product management as well as to manage and lead product portfolio and related processes' (Saaskvuori, 2011), therefore it is imperative to increase the understanding of PLM as a strategic concept with a pivotal role in business organisation and transformation. PLM is emphatically a tool of collaboration and provides a seismic shift in apparel retail management.

Therefore, it is imperative that the strategic role of PLM does not get 'lost in translation' in the extensive terminologies of the sector (Easters 2012b, p. 142) such that PLM is understood as much more than a rebadging of PDM. The weak understanding of the human and managerial dimensions of PLM systems is a barrier to companies leveraging the transformational potential of PLM (David and Rowe, 2015). This lack of vision means that PLM remains very much IT driven with consequences for the scope of planned investments and their implementation and integration into organisations. People at the user and management level within organisations need to help develop software tools that meet industry-specific needs.

PLM systems offer new opportunities to support a more integrated approach to sustainable design (Bras, 2009) with the integration of sustainability in new product development still at an early stage (Gmelin and Seuring, 2014). The concept of closed-loop product lifecycle

management (PLM) represents a mechanism to gather data on a product throughout its life thereby providing viable lifecycle data to ultimately improve the design of future products for sustainable product design and extended product lifecycles though facilitating more effective reuse and recycling value chains. PLM provides transparency throughout the entire product lifecycle (Kirirtis et al., 2008) providing the opportunity to construct and include social lifecycle assessment extending standard lifecycle assessment (LCA).

Creating innovative products relies on improving the process a company uses to realise and support new products in the full product lifecycle (CIMdata, 2002) and PLM is providing the enabling strategic platform to meet these industry challenges. However, industry case studies (Bandenelli et al., 2013; Segonds et al., 2015; Vezzetti et al., 2016) illustrate the largely intuitive and inadequate processes in many fashion and textile organisations. Through the review of business processes and workflow, PLM can help make tacit processes more apparent, opening up the black box of existing practices to critique and improvement although the introduction of technology can demand a level of formality that disrupts productive informal relationships and therefore within the system there needs to be room for the tacit and social interrelations with the system (Grieves, 2006).

By recognising that the younger generation are more disposed to using technology intuitively (Easters, 2012b), higher education has an opportunity to support change and development in the sector (Campaniaris et al., 2015; Fielding et al.,2014; Romeo and Lee, 2013) by developing a strategic understanding and vision of PLM from an organisational perspective and equipping the next generation with skills in computer-aided design, 3D garment design, 3D body scanning, and product lifecycle management systems to facilitate process improvement (Romeo and Lee, 2013). An emphasis on the importance of collaboration, extended life and the role of design in the lifecycle rather than solely on teaching the technology is recommended by Fielding et al. (2014) in order to support the realisation of the transformational potential of PLM. The need to have talented employees to overhaul legacy practices is needed in order to achieve the potential that the technology offers, as Apparel magazine notes when considering how to make the best from technology: ‘[A]chieving this will test the apparel industry’s ability to attract, foster and retain talent that embraces an end-to-end view of product life-cycle management and the still unfolding technologies that provide the operational support for success’ (Suleski and Draper, 2014). The industry’s ability to attract and retain skilled talent will be tested by this shift (OC&C Insight, 2016, Suleski and Draper 2014).

Therefore, the next generation can help realise the opportunity that PLM offers to design for the consumer more holistically and develop new practices accordingly that address end-to-

end lifecycle sustainability issues. Higher education institutes could help to foster a transformative mind-set harnessing the energy of younger generation who have a 'digital first' attitude but they also lag current industry practice (Romeo and Lee, 2013; Fielding et al., 2014). Therefore, a more collaborative and open interface between higher education, industry and industry bodies is needed to meet the future demands of the industry.

3.3.2 PLM in Higher Education: PLM as a learning tool

Given the fashion industry is a late adopter of this technology (AMR Research Inc., 2007), other disciplines within the engineering and manufacturing sectors were reviewed to identify how the concept of PLM had been integrated within higher education curricula. The aim was to understand the approach of other innovators, gain insights relating to practicalities and challenges and thereby potentially avoid repeating problems (Somekh, 2007, p. 74).

Purdue University has been engaging in PLM-related research since 1999 and also originated the first PLM education paper (Chang and Miller, 2005) which describes how a course was redesigned with 'the end goal… to prepare students with not only the knowledge of PLM but also the capability of problem solving, communication, self-motivated teamwork, and leadership …to meet industry's need for a product life cycle management (PLM) literate workforce'. This indicates that the institution is confident in their ability to represent the theoretical and technical aspects of PLM in the curriculum leaving the practice of managerial and collaborative elements to be resolved in the re-design. Across the disciplines, there is a growing interest in integrating learning with experience in practice settings. Many studies have defined the challenge of adoption of PLM into the higher education curriculum in terms of development of skills in order to be ready for industry practice (Drăghici, Brîndaşu, Savii, and Drăghici, 2007; Kakehi, Yamada and Watanabe, 2009; Moon, Contero and Mendivil, 2009; Feldhusen, Löwer, Brezing and Neis, 2010; Mejía-Gutiérrez, Carvajal-Arango and Zins, 2014; Fielding, McCardle, Eynard, Hartman and Fraser, 2014; Mora-Orozco, Guarín-Grisales, Sauza-Bedolla, D'antonio and Chiabert, 2015). These innovations all use PLM as a learning environment in conjunction with problem-based learning to develop these skills however none of these papers discuss the underlying pedagogy or how success was evaluated. Sadly, there seems little understanding that clear educational goals help to avoid errors associated with 'instrumental rationality' (Avis 2007, p. 144).

The capability to see real-world problems in a holistic manner (Therani and Tanniru, 2005 cited in Chang and Miller, 2005) is reported in these studies as being of particular significance and aligns with the strategic intent of PLM. One of the business advantages is

that PLM generates is that it adopts a process approach to connect the silos of functional teams, internal and external, to the organization through a shared collaborative platform across this extended enterprise (Ameri and Dutta, 2005) but this potential must be realised by managers embracing a life-cycle perspective from ideation, design and manufacturing (beginning of life or BOL), use (middle of life or MOL) and disposal (recycle) at the end of life (EOL). This is more easily resolved in industry training courses such as Kakehi, Yamada and Watanabe (2009) where the learner has business experience. Ncube and Crispo (2007) encourage a meaningful learning experience of 'not what but how' through the integration of gestalt principles in the organization of the curriculum in order to improve comprehension of PLM concepts. In other courses a detailed understanding of processes precedes simulated activities in the PLM system. In this way, PLM provides a learning environment for both theory and practice. As resources become scarcer, design for sustainability and products' end-of-life will gain further prominence and importance. Mora-Orozco, Guarín-Grisales, Sauza-Bedolla, D'antonio and Chiabert (2015) raise the important point that current courses deal exclusively with virtual product development i.e. the BOL –stage.

Many studies focus on the design stage reflecting the dominance of this stage in both business and education and that the size and scale of the extended life-cycle presents a barrier to a full life-cycle approach. An innovative solution to teaching the entire PLM has been achieved through a term-long collaborative project (Moon, Contero and Mendivil, 2009), where the resources and skills of three universities offering PLM courses are used to give students an experience of managing the entire lifecycle by utilizing the different technical strengths of each participating institution. In another ambitious, collaborative project aimed to better prepare engineers of the future to work effectively across distance and disciplines by establishing globally distributed teams of masters-level students based in different universities around the world with distributed work using a centralised PLM system (Mejía-Gutiérrez, et al., 2014). Despite operating over several countries with different time-zones, the students' evaluation of participating in this type of project and working with the latest generation of software was more motivating than standard projects. Further accounts on engagement with learning, with an emphasis on the lived experience and reflection of students and educators would enrich the research field.

The appropriate level of monetary and human resources is reported as a major hindrance by Feldhusen, et al., (2010) who note that this is also a barrier to adoption in the industry. The accelerated pace of software development makes teaching expertise unlikely and up-skilling a challenge when software is perpetually evolving. Use cases in industry now provided data that enables a return on investment case to be developed but the case for an educational

investment cannot use this data and must seek novel ways of resolving these issues. Industry and academia working together in an educational partnership with software partners and industry users is recommended by Fielding, McCardle, Eynard, Hartman and Fraser (2014). Reports from these partnerships would be useful to others wanting to collaborate.

The details of course structure, contents and overall teaching approach are well documented in these studies which is useful to other practioners. However, the area of the student and their learning is under-reported. The only insight into the challenges of learning PLM from a students' perspective is reported by Reisinger, Plakolm, Gurtner, Schhachermair and Probst (2015). Whilst they report positively on using a PLM system in collaborative projects, the challenges they outline are the need for additional lectures to support design engineers understanding of PLM functionalities and capabilities and the importance of standardised nomenclature for items in the system to facilitate working in a collaborative environment. As is evident in PLM research generally, there is a tendency to foreground the technology specifically (David and Rowe, 2015) that was also evident in educational research pertaining to PLM. This is understandable given its novelty but reports of how this supports learning i.e. how it works pedagogically are lacking from the accounts of these innovations. This highlights the need to attend to each of the dimensions of PLM: technological, managerial and collaborative (Corallo et al., 2013) in the developed curriculum. The potential for PLM technology is still emerging and yet results are presented with a short-term perspective as 'what works' and this in the language of generic skills development. There is also an absence of instances developed to create novel or innovative encounters. Whilst it is important to acknowledge the growing importance of digital technologies in business and society, the curricula within higher education must achieve longevity and conceptual depth rather than technical proficiency. This requires consideration in the learning design about the role of technology and its consequences, ensuring that PLM be understood as a strategic tool rather than a software to demonstrate competence in.

3.3.3 Potential for PLM in Fashion Business Education

The pace of technology developments within the retail apparel sector presents both a challenge and an opportunity for associated educational courses. Technology is transforming the manner in which people connect, communicate, collaborate and is providing educators with a range of new resources for teaching and learning. In doing so, they are reshaping and redefining our notions of what the proper role of instructors and students should be

(Ajjan and Hartstone, 2008 cited in Wankel and Blessinger, 2012). As such, the emerging paradigm is one where the educator is a facilitator of the learning process whose aim is to create the optimal learning environment to move students towards taking full responsibility for their own learning. The self-regulated student takes ownership of their learning in a way that is personal and self-sustaining (Wankel and Blessinger, 2012, pp. 3-16).

In addition, within higher education there is a growing interest in integrating learning with experience in practice settings in recognition that core models and concepts are a pedagogical oversimplification that 'make it seem as though what is taught in a course represents a body of knowledge unproblematically applicable to practice' (Wenger-Trayner et al, 2014, p. 18). It is important for students to understand that conceptual representations are a device used to illustrate the current state of practice but cannot portray the trajectory of practice. Therefore, it seems appropriate to seek a systems approach to understanding fashion production based on the paradigm of holism and synthesis and 'putting things together' and potentially more appropriate approach for depicting the industry in a complex, uncertain, real world (Fletcher and Williams, 2013) which is aligned to the call from the industry for professionals with an aptitude to 'embrace an end-to-end view of product life-cycle management and the still unfolding technologies that provide the operational support for success' (Suleski and Draper, 2014). Given the pace of technology developments within retail and the increasing levels of investment in fashion-specific PLM solutions by retailers and brands, it became evident that our future graduates' working environment would be within a PLM system and therefore should be included in the course. It was recognised that graduates would benefit from a baseline of PLM knowledge and its potential to achieve strategic transformation of the sector by recognising the realistic solutions it can generate, the problems it can solve and opportunities it can provide. As illustrated in figure 3.3, PLM provides a mechanism to update a core concept of the discipline, the 'buying cycle' given it denotes the entire value chain. Further, a PLM system also provides an up-to-date context for study that facilitates the opportunity to apply the principles of design pedagogy through a shift away from traditional lectures to collaborative learning practices. Additionally, as adoption of PLM becomes mainstream in the industry, having employees with the holistic knowledge of digital technologies and working practices is a prerequisite to achieving the potential that the technology offers.

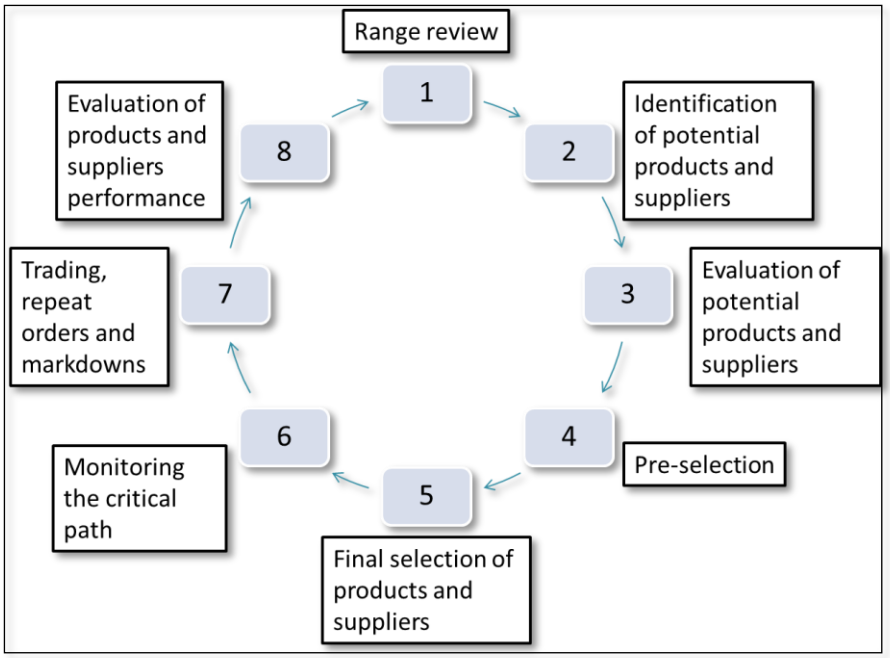


Figure 3.7 Comparison of the retail buying cycle (Goworek and McGoldrick, 2015, p. 117) and the buying cycle with PLM (txtgroup.com, n.d.)

3.4 Chapter summary

This chapter has developed the ideas introduced in chapter one to illustrate the seismic change within the retail apparel sector and associated industry. In the last 20 years the industry has been subject to rapid change due to increasingly volatile patterns of demand, the acceleration and influence of technology and the pressing need to deal with long-standing industry issues relating to worker exploitation and environmental impact. Alongside these changes, technology is also significantly affecting industrial working practice through the adoption of knowledge management systems such as product life-cycle management (PLM). The central challenge of fashion business education is how to give students a sense of this complex landscape of practice and its histories and interconnections whilst acknowledging that practice is rapidly evolving. Updating the buying cycle concept with PLM supports a shift to active learning and consequently makes learning more applicable to practice. This thesis focuses on the adoption of PLM as part of community of learning. In the scoping for this intervention a systematic literature review was conducted on the role and status of PLM in the fashion and retail sector was conducted (Conlon, 2019a) and is summarised in section 3.3.1.

Given fashion has a conservative approach to the adoption of technology, how educators within other disciplines had tackled the integration of PLM into the curricula was reviewed. These studies typically foregrounded the technology and skills development rather than the development of a mind-set capable of using technology strategically to create innovative solutions. Accordingly, the course structure was reported rather than learning. Collaboration was a strong theme throughout these studies and an industrial partnership put forward as a means of achieving a closer alignment between industry and academia. The deliberate coupling of theory and practice is supportive of a longer-term perspective beyond technical proficiency.

Beyond the scope of this thesis and therefore this chapter is a systematic review of the research pertaining to the all diverse topics that form a background this intervention. Topics such as graduate competences and the skills agenda within Higher Education, the associated notion of professional learning in relation to the knowledge economy and the role of technology in social change are therefore not reviewed specifically in this chapter.

This intervention was designed to provide a thorough understanding of PLM through an immersive learning experience simulating industry practice to support and prepare students for roles in this complex, fast-paced and challenging creative environment. The pedagogic research pertaining to fashion business calls for graduates to be better prepared for their

future professional practice with an awareness of holism and system thinking (Fletcher and Williams, 2013), tolerance of uncertainty (Tovey and Bull, 2010), knowledge of relevant digital technologies (Romeo and Lee, 2013) and use of theory (Wright and Gilmore, 2012). Accordingly, what was intended through this intervention, was an environment that promotes interaction and shared activity and the development of a mind-set capable of utilizing technological innovations to critique existing processes and practices and create alternatives that respond to the demands and opportunities of new times, new needs and changes in circumstances. The aim was to understand whether our graduates have the potential to connect technologies together creating significant efficiencies and proposing radical changes to the existing system. How these themes and ideas were investigated further is developed further in chapter four, methodology. The findings from the intervention are then presented in chapters five through seven and provides an analysis of learning in terms of practice and identity.

Chapter 4 Methodology

4.1 Introduction

The fashion and textile industry, and its contribution to society and economy, the digital disruption of fashion retail described as the emergent computer – consumer – commodity nexus (Crewe, 2013, p. 761) were discussed in chapters one and three. The pressures and complexities of the industry and of working with a growing volume of information can be overwhelming for many students, educators and organisations alike. This indicates a learning challenge for both education and the workplace that Guile calls to be addressed by '…the creation of cultures and practices in education and work, which assist people to mediate between different forms of knowledge in order to create new practices and objects...' (Guile, 2010, p. 5). Sections 3.2.2 and 3.3.2 discussed the nature of current educational research asserts that it is important to embrace both creative and academic practice within higher education (Orr and Shreeve, 2018, p. 11) as a source of critical, creative and innovative thinking (Wheelerhan, 2012, p. 157) to enable graduates to become change agents (Pasricha and Kadolph, 2009) through with an awareness of holism and system thinking (Fletcher and Williams, 2013), tolerance of uncertainty (Tovey and Bull, 2010), knowledge of relevant digital technologies (Romeo and Lee, 2013) and use of theory (Wright and Gilmore, 2012). In chapter two, Wenger's (1998) communities of practice theoretical framework provides the conceptual direction of this intervention to investigate how the subject-based and work-based aspects of the curriculum can cohere more effectively within a fashion business learning course to better support learning to become a proficient professional. One way to address these challenges is to create a digital learning environment to support and prepare students for roles in this complex, fast-paced and challenging creative environment. In chapter three, section 3.3.3, it was argued that given PLM denotes the entire value chain, it provides a mechanism to update a core concept of the discipline, the 'buying cycle' and provide the digital learning environment for a community of learning. This study examines the potential of PLM to radically transform fashion business degree level education.

The purpose of chapter two: framing concepts, was to clarify the values, assumptions and resources that underpin the formation of the research questions. This chapter builds on the theoretical concepts of chapter two to discuss how these impact on the philosophical orientation (section 4.2), methodology (section 4.3) and to clarify the data collection methods (section 4.4) and to illustrate and justify the approach to subsequent analysis

(section 4.6). Ethical considerations are discussed in section 4.5 of this chapter. The approach to data analysis utilises Wenger's (1998) learning architectures. This specific research approach is explained in section 4.7.1. This approach was not adopted from the outset of this intervention and therefore the selection of this approach for analysis over alternative approaches are also reviewed and discussed in section 4.7.3. The research questions of this study are restated in section 4.1.1 below as a reminder of the core investigation of this study.

4.1.1 Research questions

1. How might PLM support the establishment of a collaborative learning environment and provide a model for teaching and learning of fashion business in higher education?

2. What changes in the learning experience occur as a result of the intervention?

a. How do students experience learning using PLM?

b. What is the contribution that novices can make to an industry in the process of transition?

3. In what ways can Wenger's (1998) learning architecture approach be applied to understand the data from this study?

4.2 Philosophical Orientation to Research

This study is an individual practitioner-led educational research intervention that seeks to respond to Guile's (2010, p. 180) call for 'appropriate pedagogic strategies that go beyond knowledge assimilation and recognise the importance of creating and understanding cultures and activities or social practices which foster both the production and utilisation of knowledge'. This research aims to employ PLM to establish a community of learning between students, educators and industry with the intention of creating a participatory learning experience that mimics current practice rather than adding digital transformation to the curriculum. In this intervention, a PLM system is used to update, sequence and connect the subject- and work-based elements of the learning experience more coherently such that graduates are be better prepared for professional practice. Further, that engagement in practice students will contribute as change agents to tackle long-standing industry issues relating to worker exploitation and environmental impact through further consideration and critique of current practice and the broader systems that hold existing practice in place – to

illuminate engagement in practice as a source of critical and innovative thinking empowering graduates to take the practice of fashion business forward.

The study adopts a qualitative approach to design in recognition that this approach can accommodate the realisation that both the researcher and the research context are part of the process (Cresswell, 2014). Further, the qualitative approach is characterized by data that is collected in the setting where the issue exists rather than in a contrived situation, with an emergent research process is emergent i.e. may change after data collection begins and consequently multiple sources of data are gathered in order to model a holistic picture of the research setting (Cresswell, 2014). Qualitative approaches have specific philosophical perspectives i.e. ontology and epistemology that should be clarified at the start of the research process and how these are aspects influence research design is reviewed in the following paragraphs.

Ontology can be defined as a branch of philosophy that deals with the nature of reality, and how things that are thought to exist are understood and categorised (O'Leary, 2014, p. 5). The two dominant ontologies are realism (objectivism, also known as positivism), the view that the external world exists independently of perception and relativism (subjectivism, also known as constructionism or interpretivism), the view that there are no universals, that truths can only be understood in relation to their own socio-historic context. Guba (1990) employs relativism as the ontological position of the constructivist paradigm. According to Guba the relativist position implies that there are multiple interpretations of reality, locally and historically specific and none of these mental constructions can either be false or correct. This study takes its focus on the stakeholders' (figure 4.2) experiences, learning, participation and professional development, indicating the adoption of a relativist ontological position within a qualitative approach.

A subjectivist epistemology is therefore a defining feature of this study. Interpretivism, also termed constructivism, is generally equated with qualitative research. This position asserts that social phenomena and their meanings are created from perceptions and consequent actions of those social actors concerned with the intervention (Bryman, 2003, p. 23). The next element in the research process is consideration of underpinning theory. The theoretical perspective is the philosophical stance that informs the methodology and provides a context for the process and groundings in its logic and criteria (Crotty 1998, p. 3).

For practitioners interested in researching practice there are a number of approaches (Nicolini, 2012, p. 219). Practice can be a taken for granted concept (Reich and Hager, 2014). Here, practice is considered as a form of tradition that can be theorised by employing the theory of communities of practice to understand how practice is reproduced over time. Practice, in this conception, is considered as a process of active engagement and participation within a specific community. This perspective focuses on how novices are socialised, the artefacts employed and how practices are made durable or change with time (Nicolini, 2012, p. 220). Hence, a communities of practice approach represents practice by focusing on legitimacy and learning. The community of learning was designed as a recreation, rather than a precise replication, of the practices of a buying team in a learning environment. As outlined in chapter two, communities of practice (Wenger, 1998) was adopted to frame the learning design of this intervention with diverse opportunities for active participation in practice embedded into the curriculum. This active participation is a central premise in the module redesign where the purpose for newcomers is 'not to learn from talk as a substitute for legitimate peripheral participation; it is to learn to talk as a key to legitimate peripheral participation' (Lave and Wenger, 1991, p. 109). It has been argued that a communities of practice approach supports the principles of a design pedagogy. Learning occurs as newcomers participate in practice along a trajectory from a position of peripheral participation to full participation not just through a process of socialization but by becoming a participating member of the community (Johri, 2014, p. 114). This conceptualisation of learning as occurring in practice challenges the prominent understanding of learning of behaviouralist and cognitive learning theories (Reich and Hager, 2014).

As described in chapter two, the theory of communities of practice provides a perspective to understand the contribution of the social context to learning and is employed in this study to understand the learning design that underpins the identity work that students engage in as they develop professionally. Further, the desired outcome of learning is more than the acquisition of knowledge and skills but competence that is experienced in and recognised by the community. Consequently, Wenger argues (1998, p. 153) that a sense of identity results from competence and membership of the community. This theoretical approach is considered particularly relevant in situations that have a significant historical and cultural context and where participants, their purposes and their tools are in a process of process of rapid and constant change and provides a mechanism to capture the user in context (Nicolini, 2012, p. 220).

4.3 Methodology: action research

Action research is commonly described as one form of qualitative research that is sensitive to context (Somekh, 2006). According, it can be seen as a type of applied research differentiated from traditional approaches to research in that it is motivated by a desire to effect a change for the better in a certain context and to understand why this is an improvement rather than to generate knowledge in a detached way. Action research offers an alternative approach for 'bottom-up' change through collaborative relationships rather than in response to 'top-down' directives (Somekh (2006), Wallace (1987)). The methodology of Action Research pervades pedagogical and curriculum theory research (Gibbs et al., 2017). Ontologically, action research is differentiated from other forms a research: 'action research is value laden and morally committed, which is a transformation of the assumption that research can be value free' (McNiff and Whitehead 2011, p. 30). The positionality inherent in practitioner research and how this has been handled is discussed in section 4.6. In this way, action research can be seen to bridge the divide between research and practice (action) (Gibbs et al., 2017; Somekh, 2005).

Action research can be understood as a social practice that aims to transform other social practices (Kemmis, McTaggart and Nixon, 2014, p. 27), as 'practice changing practice' (Kemmis, 2009 cited in Kemmis, McTaggart and Nixon, 2014). The aim of the intervention is to facilitate the development of graduates with a holistic mind-set capable of using technological innovation to critique existing processes and practice and contribute to the generation of the solutions needed in the industry. Therefore, this intervention aligns well with the aspirations for change of action research. Further, as this intervention has involved working collaboratively with a range of stakeholders to establish a community of practice to support students' professional development, an action research approach was also seen as capable of accommodating the participatory and collaborative nature of the intervention.

Action research has been defined as the 'study of the social situation with a view to improving the quality of action within it' (Elliott 1991, p. 69, cited in Denscombe, 2010). Given the breadth of possible contexts and practices that this definition could be applicable to, action research can only be defined in broad terms as it is often described as a family of practices (Reason and Bradbury, 2008, p. 1) carried out by the people directly concerned with the social situation that is being researched (Somekh 1995, p. 340). This family is able to incorporate a diversity of approaches that vary in their degree of participation, use of external facilitators and critical stances (Somekh 2005, cited in Somekh and Lewin, 2005). The philosophical stances of different modes of action research has been summarised into three categories relating to their aims and consists of technical-, practical- and

emancipatory- action research. Technical action research promotes more efficient and effective practice whereas practical action research fosters the development of professionalism and emancipatory action research promotes a critical consciousness which exhibits itself in political as well as practical action to promote change (Grundy, 1987). The categories of technical-, practical- and emancipatory- action research align with Noffke's three dimensions: the professional, the personal and the political (Somekh 2005, cited in Somekh and Lewin, 2005).

Many action research studies are written up as individual case studies (Wallace, 1987) and there is some degree of correlation in these methodologies. In fact, in the initial stages of the partnership, this study had a technical phase to develop the rationale for the planned intervention. During this technical phase, it was planned to produce an educational case study of PLM used in an apparel retail context. In hindsight, it is apparent that in the period around the formation of the educational partnership for PLM, a focus on the PLM technology itself had begun to dominate and is summarised in section 4.4.6. with the main research focus to provide an auto-ethnographic account of how the process of change had been managed, a model of the learning design with an evaluation. This could be viewed as taking a 'what-works' technical action research approach detailing how to efficiently implement PLM into higher education disseminated as case study. However, it was recognised that 'what-works' was at odds with a situated learning approach where the significance of the practice setting is acknowledged suggesting an ease of transferability that is at odds with a situated learning perspective and a shift in focus occurred.

Consequently, a shift in focus to the learning experience within the intervention was established as the main contribution of this study by examining the potential of PLM to radically transform fashion business degree level education. At this stage there was a refocusing on the specific research questions that directed the intervention to refocus on the pedagogy rather than technology by foregrounding learning whilst acknowledging that these two elements are increasingly 'entangled' (Orlikowiski, 2010, p. 135) in practice and therefore the focus is on the constitutive entanglements of students and technology in everyday practice. This has been elegantly described by Anderson and Dron (2011, p. 81) as 'the two being intertwined in a dance: the technology sets the beat and creates the music, while the pedagogy defines the moves.' An action research approach is more appropriate to answer research questions that focus on situated learning and pedagogy whereas a case study approach would direct the attention to the role of the technology; that the study aligned most closely with action research as characterized by 'research in action', rather than conceptions aligned with a case study of 'research on action' (Somekh, 2005).

The theoretical and political roots of Action Research mean that researchers frequently explore social justice and emancipation with this approach and this element further reinforced the appropriateness of action research as a methodology for this study. The praxis model of education makes an explicit commitment to emancipation (Kemmis and Smith, 2007). Whilst this intervention did not deliberately foreground a praxis approach, it does consider itself to be a form of emancipatory research given that strategic action was taken to improve contextual practices in order to trigger a greater consideration of the industry's long-standing challenges. The students themselves are participants in the project, not merely the recipients of change. The aspiration is that through directly experiencing industry practice through a PLM learning environment that students will be more critically aware of the underpinning business model; in this way it can be considered to be a political process because it involves making changes that will affect others (Kemmis and McTaggart, 1992, pp. 22 – 5, cited in Cohen, Manion and Morrison, 2007, p. 299). It recognizes that improvements to the system will only be achieved as structural change accompanies and enables individual change and further action. Although the aspirations for this intervention are high, the expectations are modest in line with Grundy's clarification that:

> *… emancipation will remain a prize to inspire the struggle rather than a goal readily achieved. At any one time it is probable that the most such a project will achieve is the engendering of a critical consciousness in the participants, with perhaps only 'skirmishes of position' on the action front (Grundy, 1987, p. 154).*

That is not to diminish the power of education but to limit expectations of outcomes achievable from any one intervention.

4.4 Data collection methods

4.4.1 Intervention timeline

The aim of the intervention was to establish a collaborative learning community within a knowledge management system to mimic the practices of a retail buying team. PLM has been integrated into the course through a phased implementation from 2014 to 2018 with each academic year representing an action research cycle as detailed in appendix 8. In 2014, teaching and learning of PLM was integrated into an existing module on global sourcing with two assessment tasks – a report on industry practice in term one and a case study in term two. This thesis reports on this first action research cycle of the implementation of PLM into the curriculum in 2014-15 as illustrated in figure 4.1 and

described below. The live nature of the implementation meant the teaching plan had to be responsive to changes that occurred during the initial stages, with two major adjustments incorporated as illustrated in green in figure 4.2. The impact of making space in the teaching and learning plan to be responsive in this way is discussed in 5.2.3. This section illustrates the 'messy business' (Kemmis et al., 2014, p. 86) of action research for changing teaching and learning.

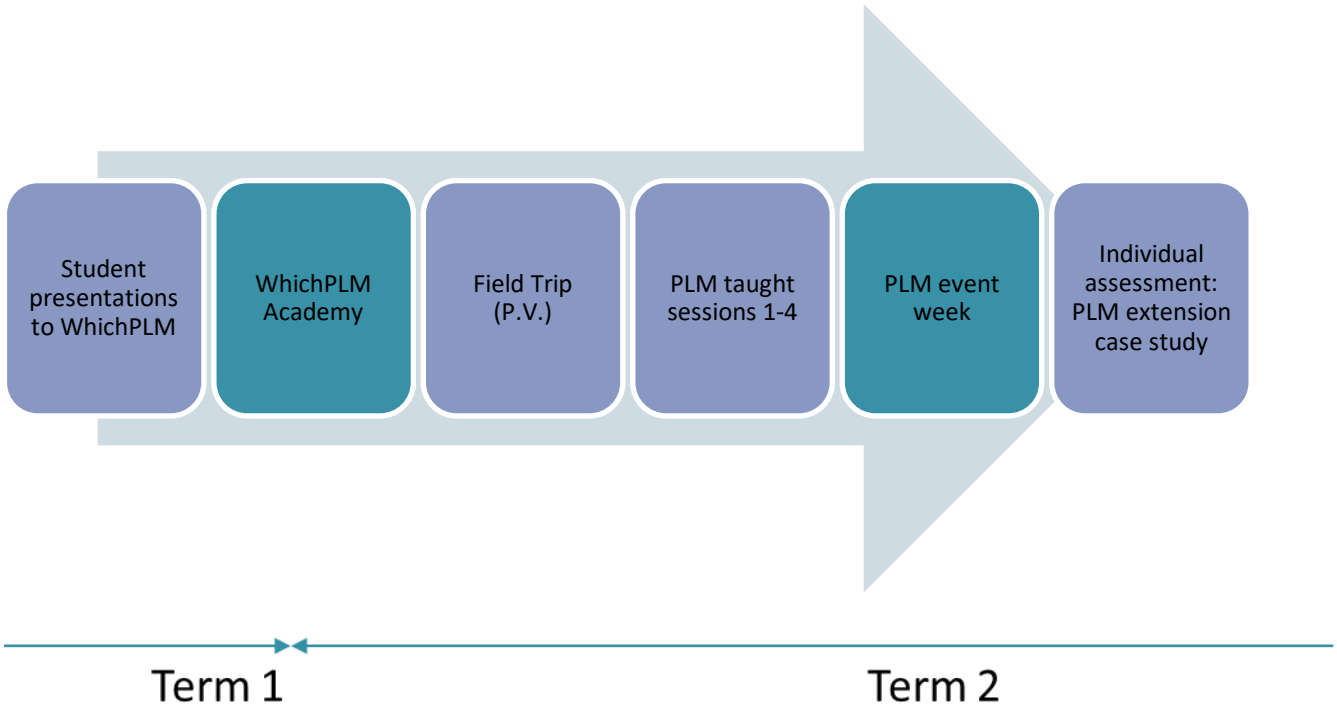


Figure 4.1 Broad Design for Learning 2014-15 (Blue = planned, green = emerged)

In term one, PLM was introduced generically in term one with applied activities in term two when the on-site system became 'live' in January 2015. In term two, the taught sessions using the PLM software, described in section 4.4.4. were scheduled after the field trip to the trade show Première Vision in Paris. In term one, lectures and guest speakers introduced the industry drivers to PLM adoption and its reported benefits. During this stage, the students presented their knowledge of PLM to a team from WhichPLM, a digital magazine and advisory service dedicated to PLM for the retail fashion industry (figure 4.2). An editorial written based on the visit can be found in appendix 3 which is the first of five pieces detailing the intervention and these are presented in appendices 4 through 7. During this first visit Mark Harrop, founder and managing director of WhichPLM, declared that the reality of the future workplace within fashion was within a PLM system and he gifted the

cohort access to the four introductory modules of the bronze level of the WhichPLM academy, an online PDP package with the of aim of helping apparel, footwear and textiles business professionals understand PLM. The plan for teaching and learning was adapted to reflect this opportunity, indicated in green in figure 4.1.

Figure 4.2 Members of WhichPLM with some of the undergraduates 2014-15

Certainly, having a guest speaker of such calibre and generosity at this early stage supported the legitimacy of the intervention by enabling the students develop their understanding of PLM in the industry independently and their role as participants in this action research initiative. The degree to which the students valued this external contribution and validation of their learning is discussed further in the findings chapter six (section 6.2.2).

A further adjustment to the teaching plan was made when it became evident through discussions on final year dissertation research topics that many of the final year students had an interest in management processes and technology. Although it had not been planned to involve the final year within the project, there was a clear opportunity for a sharing of experience between the second and final year. An optional collaborative week-long event with a live brief from industry, termed 'PLM event week' (in green in figure 4.1), was organised in order to provide an opportunity to share technical skills on PLM with greater industry experience from placement. The brief and event feedback questionnaire can be found in appendix 12. A summary of the teaching and learning activities of term two is presented in figure 4.3.

Figure 4.3 Summary of the teaching and learning activities of term two (2014-15)

4.4.2 Introduction to the data sources

As illustrated in table 4.1, data were collected throughout the technical and pedagogical phases of the intervention. The data from the technical phase is not included in this thesis as discussed in section 4.4.6.

In terms of methods in the pedagogic phase, it was a priority not to disturb the research setting but to find a means by which learning environment could be brought back to life during the process of analysis and subsequent dissemination was required. Therefore, the taught sessions, presentations and post-event debriefs were video recorded. This enabled the learning environment to be reviewed many times and the ebb and flow of energy and interest in response to the activities studied. The students were reassured that the video comments would be anonymized and that with a large group in a class it was almost impossible to identify conversations. The students are familiar with the use of end of class surveys and this data collection method was also employed after each teaching session and at the end of the event week. The first assignment includes a reflective element but this was designed to reflect on industry practice rather than professional development. In hindsight it would have been useful to have incorporated reflections on personal development but this was beyond the scope of what was achievable. However, the titles of case study topics (the second assessment) have been used as data. The final stage of data collection emerged from initial analysis where it became evident that this experience had been particularly transformative to a group termed 'early PLM adopters'. The graduates in this group were contacted through LinkedIn to complete reflective vignettes and the second years (now in their final year) were invited to an additional recall activity and requested to complete the reflective vignettes.

The intervention is complex and draws on a range of data sources across the two phases. Table 4.1 summarises the sources which are then explained in sections 4.4.3, 4.4.4, 4.4.5 and 4.4.6.

Table 4.1 Summary of data sources

Timing	Participants	Data type	Sampling method	Anonymity
Phase 1: Technical	Course team	Minutes, documents	Convenience	No
	Stakeholders	Minutes	Convenience	No
	Training sessions	Training materials, field notes	Convenience	No
Phase 2: Pedagogical	Y2 students	Video of teaching and learning activities, survey	Convenience	Yes
	PLM teams	Video of team presentations to industry panel, survey	Convenience	Yes
	Y2 students	Video of debrief	Convenience	Yes
	Final year "early adopters"	Interviews and reflective vignette	Convenience	Yes
	Second year "early adopters"	Focus group: recall activity and reflective vignette	Convenience	Yes

4.4.3 Setting and participants

This intervention is the first venture to embed a PLM philosophy and system within an undergraduate course aligned with the RFA sector (Ashworth, 2014) and therefore the sample is both convenient and pragmatic. The unit of analysis is the community of learning that centres on this global sourcing 40-credit compulsory module at level five.

The intervention was implemented within an undergraduate fashion business course at a UK post-92 university. As outlined in chapter one (section 1.1), there is a blend of management and design pedagogies with some theoretical lectures alongside collaborative workshops, projects and live briefs designed to scaffold the transition from student to professional practitioner. The main study population (n= 28) were the 2014-15 second-year cohort of a 40 credit, compulsory module. Additionally, data was collected from the participants of an immersive week-long optional event around the live brief termed ‘PLM event week’; n=37 total students where n=21 second year students and n=16 final year students.

The intention behind this intervention is not to provide the industry with an army of PLM advocates but to examine the ways in which PLM changes students learning. The insights and reflections from those who have successfully used PLM within their studies and their professional identity develops and is changed by the PLM work is the focus for the study. Subsequent to the PLM related teaching and learning activities, a group of final years who were identified through their research topics as 'early PLM adopters' (n=3) also participated in further interviews directly after graduation and completed the reflective vignette template (appendix 9). Vignettes offer a means to enhance the richness of qualitative research (Humphreys, 2005) and highlight the particular attributes that an individual brings to the community. In order to gather a more detached and longitudinal perspective commenting on learning impacts, data was also collected from a group of 'early PLM adopters' (n=5) from the 2014-15 Y2 cohort. These participants were asked to participate in a recall activity (appendix 10) using photo stills taken from the video recordings and complete the reflective vignette template. This provides data about how and why the groups of 'early PLM adopters' have used PLM to develop a professional identity and support a trajectory into the industry.

4.4.4 Developing the teaching and learning activities of term two (2014-15)

In the first year of the intervention, the learning activities needed to be designed to incorporate the PLM approach within an existing module on global sourcing. PTC's FlexPLM is the package that was used on the module. It is one of the industry standard software tools for PLM. To learn how to use FlexPLM requires a considerable investment in time. Staff were given this training by PTC's implementation partner, ITC Infotech. This training adapted the 14 module, four-day PTC agenda: product development (design), merchandising (margin and critical path), technical aspects and buying (range planning) shown in figure 4.4.

PTC University

Agenda

Day 1

Module 1	Introduction to the FlexPLM Environment
Module 2	Locating and Viewing Information
Module 3	Working in the Libraries
Module 4	Managing Materials

Day 2

Module 5	Working with Palettes
Module 6	Managing Seasons
Module 7	Working with Plans
Module 8	Creating and Managing Products

Day 3

Module 9	Adding Products and Colorways to a Season
Module 10	Working with the Line Sheet Editor
Module 11	Working with Product Sources and Cost Sheets

Day 4

Module 12	Working with Product Specifications
Module 13	Working with Product Samples
Module 14	Working with Vendor Portal

Figure 4.4 Standard training programme for PTC's FlexPLM

The initial implementation was simplified from this by removing the event calendar, work flow and product planning and ordering in order to focus on the processes and practices of new product development (NPD) most relevant to the module. Figure 4.5 shows the

flipchart that outlined the two-day staff training that was then used to adapt the initial plan for teaching and learning shown in figure 4.6.

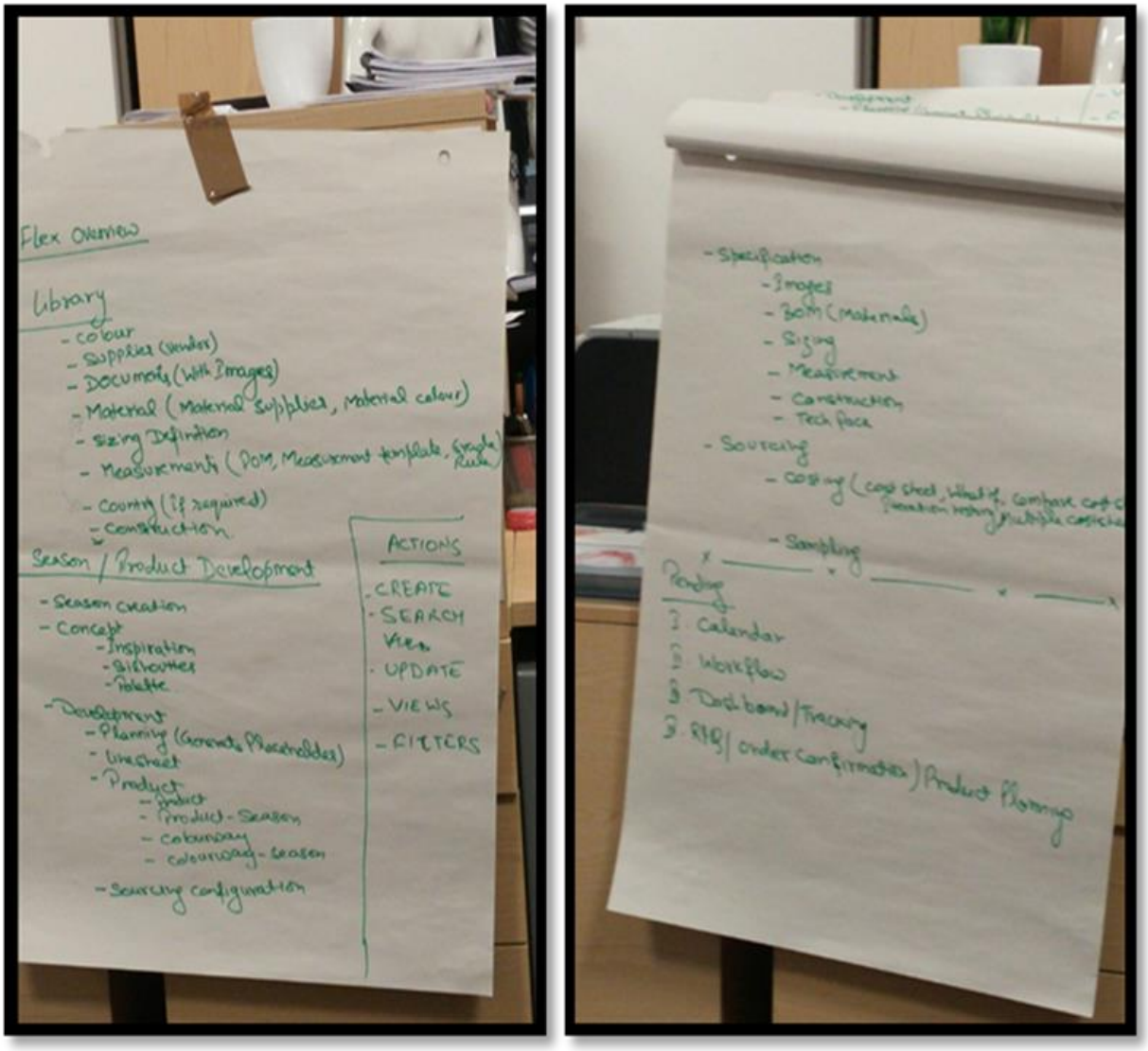


Figure 4.5 ITC Infotech adaption of the training methodology

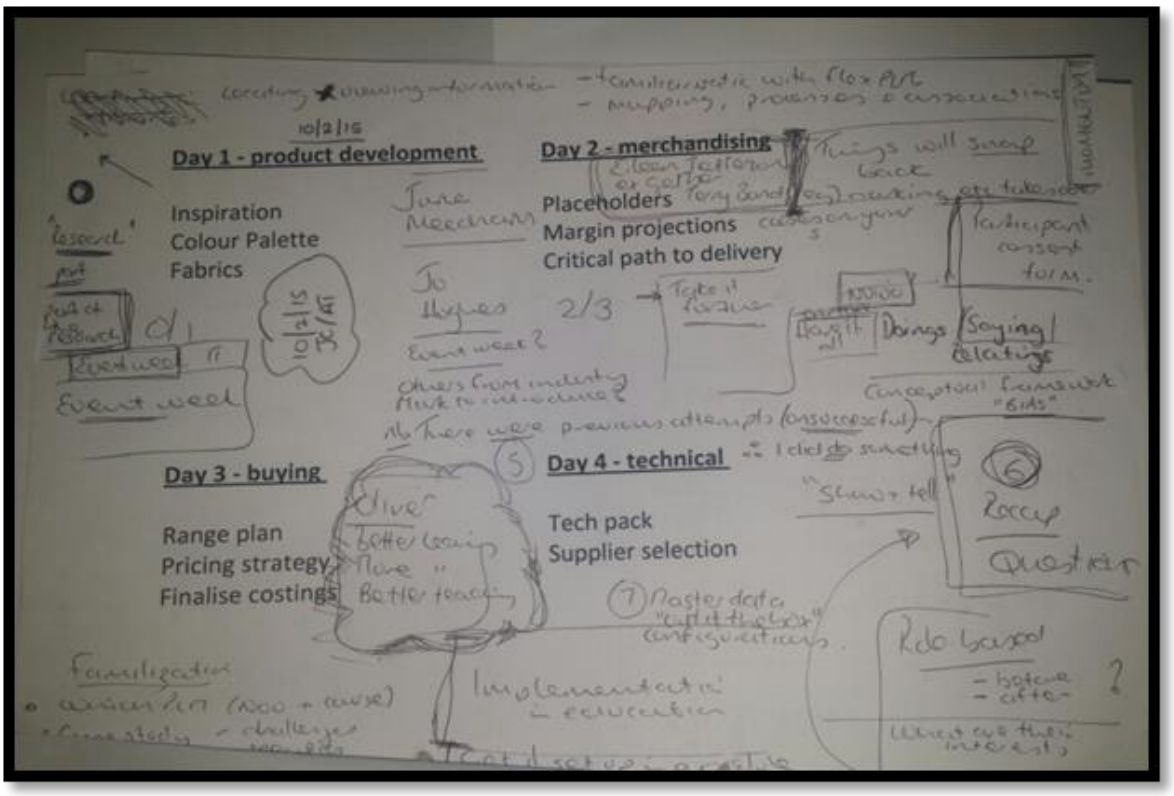


Figure 4.6 Amending the plan for teaching and learning after training

The training emphasised the key actions to be learned in order to become familiar with loading, locating and connecting information in order to generate a technical package or specification to initiate production and resulted in four teaching sessions: working in the library, sourcing consideration, garment specification and generating the technical package as shown in figure 4.7. The optional 'PLM event week' was added to provide the students with the opportunity of working collaboratively on a live brief from George at Asda in teams derived from the course cohort. In the scenario of the brief the retailer has made available additional budget, termed 'open to buy', to respond to missed opportunities. The students develop a range proposal to make a bid for this additional budget. This activity culminated with each team 'performing' the buying practices of preparing a range proposal to the external panel for feedback and supported with 'tech-packs' such that production could start promptly.

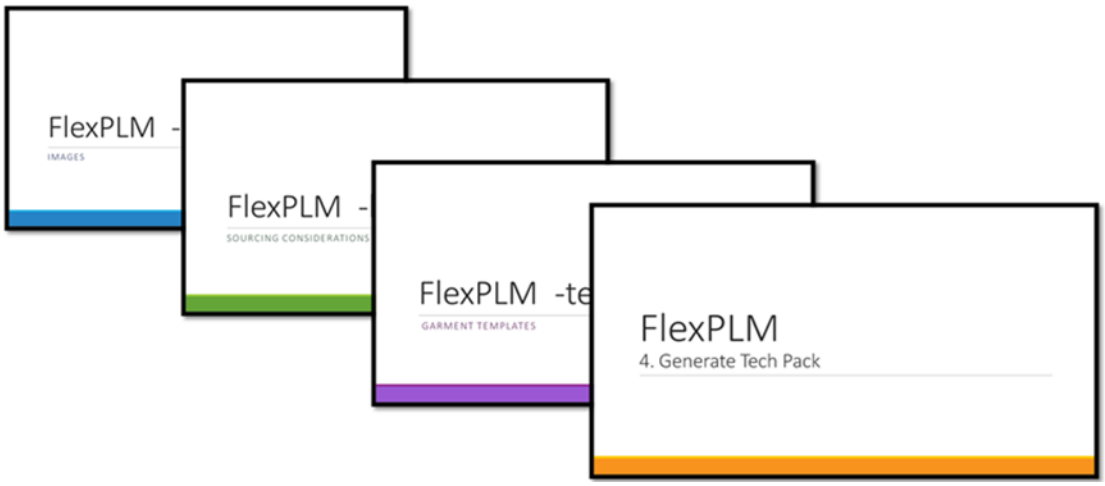


Figure 4.7 Teaching resources developed from the PLM agenda and ITC Infotech training methodology

After the PLM event week, the students returned to the formal taught course as shown in part 3 of figure 4.2. This part focused on supporting the students' individual research using PLM as a platform for other technologies. The second assessment was an individual case study assessment (5000 words), where students undertook primary research to understand current practice and to research into innovative, strategic and applied opportunities for extended PLM to technologies and proposed business improvements in diverse topics.

4.4.5 Data collection in the first iteration of the action research cycle

Each of the four PLM teaching sessions were videoed in order to capture these moments (figure 4.8), as a reconstruction of action (Grundy, 1987, p. 159) for later reflection and analysis. Students were also asked to anonymously complete a feedback survey following the taught sessions (appendix 11). The video and transcription process were considered an important method capable of encouraging and informing reconstruction of the events during the later analysis process that could be supplemented with survey responses and follow-up discussions.

During 'PLM event week', the student presentations and Q&A sessions were videoed. No video recordings of student teamwork activities were made during the event week as it was viewed this would inhibit effective team working. As an alternative, students were also asked to anonymously complete a feedback survey following the event week (appendix 12) and invited to de-brief session. The data collected and analysed is summarised in table 4.1.

and in appendix 13. In common with other action research there was a surfeit of data which was very 'messy' (Cook, 2009, p. 279).

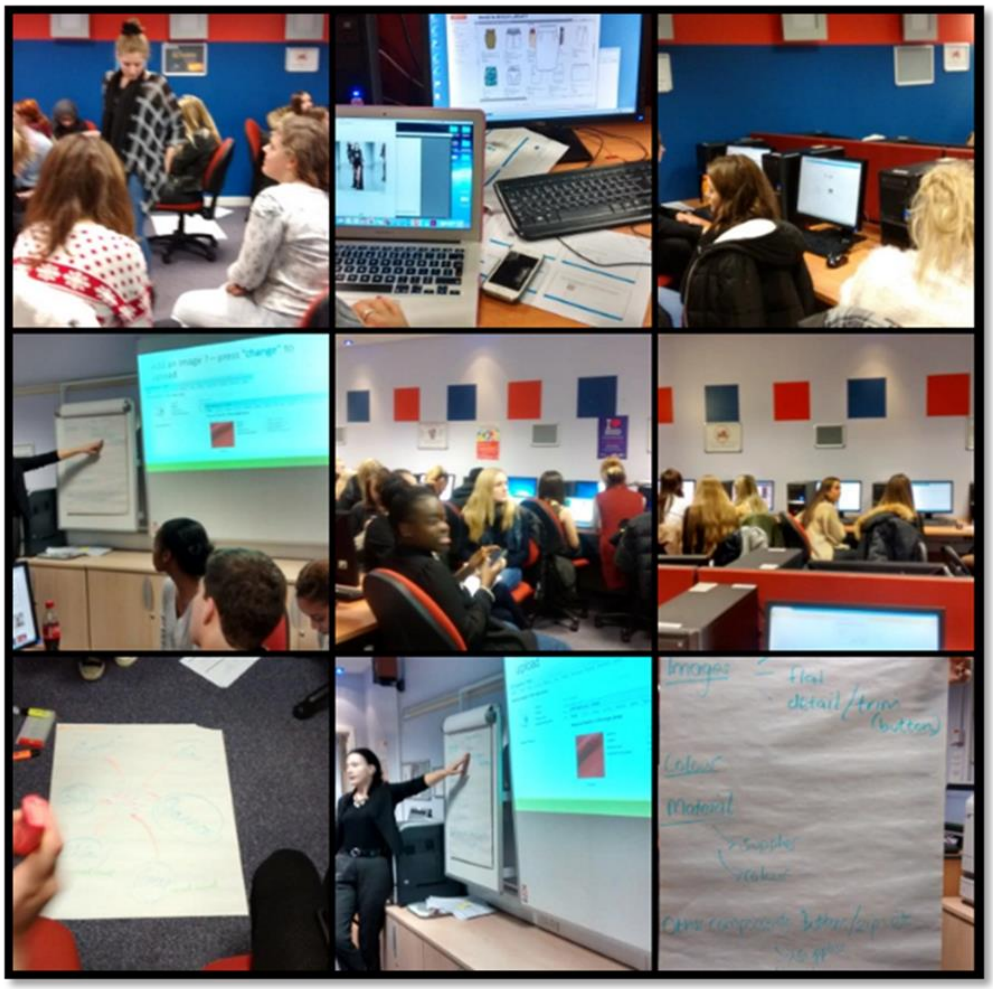


Figure 4.8 Graphic depicting the teaching and learning experience

The intervention has benefitted from a colleague acting as a 'critical friend' (Stenhouse, 1975 cited in Kember et al., 1997, p. 464) proactively supporting the teacher-researcher role. This colleague also supported the research practically by recording the video of these sessions. The role of a critical friend in validating the interpretation of the data is discussed in section 4.6.

4.4.6 Process Transparency: data from the technical phase of the PLM implementation

The intervention had 2 phases with 14 data sources summarised in table 4.1. The data from phase 1: technical phase (May 2014 - February 2015), where the focus was on evaluation of the intervention, consists of meeting minutes and written resources. In phase 2: pedagogic phase (from February 2015) the data is from videos, interviews and other reflective accounts where a more holistic approach was taken to the data and analysis.

A large volume of data was collected during the technical phase of the intervention relating to the partnership formation and software implementation. The details of the technical phase are outlined here to provide clarity and understanding of the processes of the implementation but are not used explicitly in the findings chapters and are shown in appendices 12 through 16.

A course meeting was organised with the four members of the course team to communicate the vision of the intervention and to specifically establish clear and measurable aims and objectives for the planned intervention before implementation. Although, this intervention was conducted within one module but it was recognised that it would have wider implications for whole programme and therefore other course team members were invited to be part of the change. The meeting was organised and documented using an adaptation of the evaluative tool 'RUFDATA' (Saunders, 2000) to prompt discussions and provide a mechanism to chart the main reasons and purposes of the initiative is, the specific benefits, particular focus areas, agreed measures for evaluation, the audience, timing and participants (appendix 14). PLM has been integrated into the course since the academic year 2014-15. There are a number of internal (6) and external (3) stakeholders in the project as shown in appendix 1. Additionally, the emphasis on the learning at the practice level of undergraduate students necessitated that other areas, the organisational, managerial and financial, remain largely undiscussed although these necessarily had to be navigated in the project; a summary of the 'lessons learnt' is reported (Conlon, 2019b) in appendix 15. Independent PLM expertise has been contributed by Mark Harrop, M.D. of WhichPLM, a digital magazine and advisory service.

4.5 Ethical Considerations

The good practice principle advocated to project researchers is to identify a code of ethics that represents their academic discipline or professional association (Denscombe 2010, p. 330). For educational research conducted in England this is British Education Research

Association (BERA). The association outlines (BERA 2011, p. 4) how the guidelines are underpinned by the principles that all educational research should be conducted within an ethic of respect for:

- The person
- Knowledge
- Democratic values
- The quality of educational research
- Academic freedom

Although there is now a fourth edition in 2018, at the time of data collection, the relevant published guidelines were the third edition (BERA, 2011). The key principles are:

- The participants are fully informed of the project
- The participants agree to partake with the knowledge that they have the right to withdraw at any time
- The confidentiality and anonymity of participants is ensured
- That data collected is stored protecting the identity of participants, in a secure condition in a manner accessible only by the researcher

From the outset of this intervention, there have been deliberate efforts to publicise the formation of the educational partnership and disseminate initial findings. Accordingly, maintaining the confidentiality and anonymity of participants was not achievable within this intervention. Although the identity of those providing research data can be protected as an individual level through the use of pseudonyms, the cohort is clearly identifiable. It was necessary to make this clear so that participants could give informed consent. Participants were provided with details of the planned research at the beginning of term in October 2014. Participants were reassured that the intention of educational research is to seek to maximise the benefits whilst assuring no harm (BERA, 2011).

Further, there is value of dissemination in that the publicity may lead to increased opportunities for self-promotion as a participant of this study. The details of the research along with the teaching plan were discussed in order for them to have time to consider their participation before research and publicity started in November 2014. Permission for materials used for publicity are requested separately and explicitly from the research project. Participant information sheets and consent forms were modified accordingly to note

the lack of confidentiality and anonymity and then prepared and completed in accordance with the University's guidelines and the participant information form can be found in appendix 16.

While there are advantages of insider knowledge (Somekh, 2005), there could be a perceived conflict-of-interest in my role as an academic and researcher. The impact of the closeness of the researcher to the study is often cited as limiting validity in action research and this is discussed further in section 4.6. It could be conceived that students may feel compelled to participate and to give positive feedback. To address this concern care was taken to ensure that much of the data was collected anonymously to ensure the open contributions for the students as stakeholders in the project were established. The surveys after each session were completed anonymously with space for free comments. The video and transcription process were considered an important method capable of encouraging and informing reconstruction of the events and group dynamic during the later analysis process. The voices of the 'early adopters' form a large part of the data used for analysis. Many of these students waived their right for confidentiality and anonymity but a consistent approach of using a pseudonym for all members of this group was adopted.

In its guidelines BERA state the responsibilities to participants that all researchers must uphold but also extends this responsibility to include the sponsors of the research, the research community and the general public (BERA, 2011). There may also be a concern regarding how the expectations of the PLM software provider can be managed within an educational context. A partnership agreement has been formulated and agreed by the Dean of the School. There are no pre-conceived outcomes. There is no long-term 'tie-in' for either party. Thus, ethical research extends beyond consideration of the participant and data collection to the reporting of the results. In order to review this extended aspect of quality the criteria presented in the document 'Quality in Qualitative Evaluation: A framework for assessing research evidence' (Spencer, Ritchie, Lewis and Dillon, 2003) is proposed to guide a deep consideration for the quality of the research project. The framework (Spencer et al., 2003) is based around four guiding principles: the need to contribute to advancing wider knowledge, that the research design strategy is defensible, that the research has been rigorous in conduct through systematic and transparent collection, analysis and interpretation of qualitative data and offers a credible claim for the research contribution through well-founded and plausible arguments about significance of the data generated. This framework has provided the underpinning principles of this research.

4.6 Quality Criteria for Action Research

Qualitative research requires a reconsideration of the concepts of generalisability, internal validity, reliability and objectivity and alternative terms including transferability, credibility, dependability and confirmability are commonly adopted (Lincoln and Guber, 1985). However, these concepts rest on first establishing transparency regarding the assumptions and biases, that will influence choices and decisions taken within the research process and how these have been managed (Given, 2008, p. 891). Within action research, researchers are driven to make changes to their existing practice i.e. to take action. This call to action or innovation is underpinned by a particular set of values and beliefs. This results in the central conundrum of action research how to appropriately balance being an insider and advocate for change within the research with a regard for upholding research quality and relevance. Therefore, a challenge of action research is to balance the roles of practitioner and researcher and moderate for this positionality.

This thesis argues that PLM offers a new approach to the pedagogy of fashion business management. This position has been transparently communicated through the previous chapters whilst adopting a critical approach to the data. The extant literature presented in chapter three demonstrated that there is a broader recognition of the need for change in order for graduates to be better prepared for their future professional practice and therefore the direction of this intervention was verified. Change courses require both teamwork and leadership (JISC, 2006) and therefore practitioner action research lead by a strong advocate for the change will be conducive to delivering the planned implementation. At the local level, active and regular engagement with the participants, the course team and wider stakeholders has created a network of 'critical friends' (McKenney and Reeves, 2012, p. 85) to inform the research through exposure to wider perspectives. PLM implementations are complex and this strong collaborative team (internally and externally) and the feedback of students has also acted as an important source of encouragement. Regular dissemination at departmental away days, school and university teaching and learning conferences has also maintained an open approach to the research questions through deliberate efforts to seek feedback. Confirmability, instead of objectivity, rests on reporting the data and their interpretation accurately in the findings.

Credibility can be considered to be the parallel concept of internal validity and rests on rich and accurate description of the research experience. Achieving reliability within the social world is recognised to be challenging and the term dependability adopted as the parallel of reliability. Three indicators of credibility and dependability are offered by Given (2008, pp. 753-4):

- methodological coherence (the appropriate and thorough collection, analysis, and interpretation of data),
- researcher responsiveness (the early and ongoing verification of findings and analyses with study participants)
- audit trails (a transparent description of all procedures and issues relative to the research project)

The stakeholders within this project believe that the findings of this intervention can have wider applicability. Generalisability refers to the application of research findings across wide contexts, whereas transferability reflects how the findings may be applicable to alternative contexts whilst recognising the limit of research conducted to improve practice at local level. This intervention adopts a situated learning perspective, therefore the recognises the significance of the context where the practice occurs and how the site is also a set of conditions that impact on practice. This is consistent with social practice theory where the practice landscape and its associated practice traditions are recognised to be as significant as the practices under scrutiny and transformation, Kemmis et al. (2014, p. 4) highlight the consequences of this: 'we cannot transform practices without transforming existing arrangements in the intersubjective spaces that support practices' . This is echoed by Fuller (2007) who states that three components: new materials, new teaching approaches and an alteration of pedagogic assumptions need to change if a practice is to be transformed. It is across these dimensions that the shared experience of undergraduate teaching and learning of fashion business and management has certain commonalities. These commonalities were detailed in section 4.4.3. to argue for a high degree of relevance to wider practice. The reader can then judge the degree of alignment by contrasting the approach presented here with their own practice. The intention of the findings chapters is that others will see a relevance to their own practice and can learn from this intervention rather than presenting 'one best way' (Kemmis, McTaggart and Nixon, 2014, p. 69).

So, although this intervention is unique, these shared issues and experiences will have connections with the reader's tacit knowledge of this field and therefore dissemination of this case study should yield pragmatic outcomes for others to build into their understandings of this topic.

4.7 Analysis

Although, from the outset, this intervention adopted a communities of practice approach, it was Tummons' (2014) use of Wenger's under-used notion of a learning architecture, that this conceptual framework was adopted for data analysis. The learning architectures has been significant in illuminating the design that facilitates a sense of the community of fashion business practice. Wenger presents his learning architecture as an epilogue to his 1998 text communities of practice. This approach, which has had significantly less exposure than the communities of practice theory has much to offer learning design and an understanding of how this supports learning. Tummons (2018, p. 3) recommends Wenger's learning architecture as a conceptual framework to position pedagogy within a communities of practice perspective which is outlined in the following subsection. There are similarities in this approach to Goodyear's schema for educational design (2002, p. 65). Lees and Meyer (2011) have also found Wenger's framework to be a useful heuristic in pedagogic development and subsequent evaluation.

4.7.1 Learning architectures

The introduction of learning architectures (1998, pp. 231 -240), allows for more rigorous treatment of communities of practice within formal education rather than as an intuitive notion. The role of pedagogy within a community of practice is neatly reconciled by making it one of many resources available to students:

> *…teaching does not cause learning: what ends up being learned may or may not be what was taught, or more generally what the institutional organisation of instruction intended. Learning is an emergent, ongoing process which may use teaching as one of the many structuring resources (Wenger, 1998 p. 267).*

As experience frequently demonstrates, learning is unpredictable. Wenger concedes an important caveat - that the final design cannot be guaranteed to realise the desired result: 'Learning cannot be designed, it can only be designed *for* – that is, facilitated or frustrated.' (1998, p. 229). However, a learning architecture approach helps to emphasise design considerations - the curriculum, the environment, the people etc. that provide students with the opportunity to participate in the community practice – and hence the opportunity to learn. Learning emerges in response to this design. For Wenger (1998), a learning architecture is constructed from four theoretical elements of communities of practice theory which he terms dualities reflecting the interrelated theoretical aspect of each element. The

four dualities are: reification and participation; designed and emergent; local and global; and identification and negotiability (Wenger, 1998, p. 271). The learning architecture joins these dualities together to define a space for learning (Wenger, 1998, p. 236). So, although learning cannot be designed directly through considerations around the learning architectures it is possible to design for learning. It is then possible to reflect on the design to consider the attributes that facilitated learning more than others.

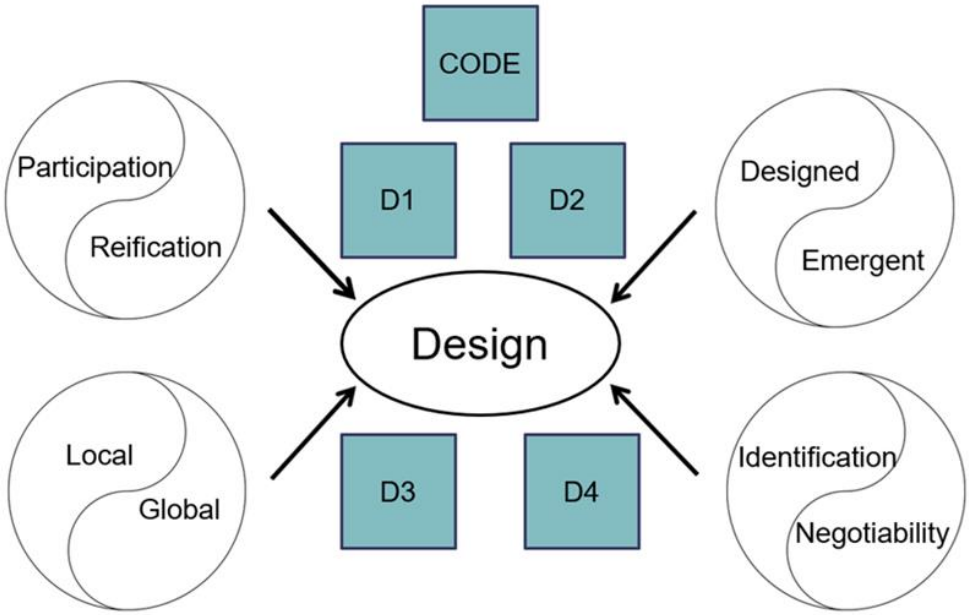


Figure 4.9 Four dimensions of design for learning (Wenger, 1998, p. 232) with coding nodes

The individual dimensions of these four dualities are portrayed in figure 4.9 as distinct but connected and are represented as having two components; Wenger (1998) uses the yin and yang symbol, popularly called taijitu to highlight the significance of balancing the dual nature of each dimension. The design dimensions are captured as four dualities to convey the design issues relating to meaning, time, space and power (Wenger, 1998, p. 231) to be addressed in order to support the three infrastructural components: engagement, imagination and alignment. Design decisions adjust the balance of these components (Scanlan, 2013). The dimensions of learning architecture can then be used to open up the design to discussion and make decisions visible. Each of the dualities and components are considered below but how each of Wenger's (1998) four dualities relates to decision making can be summarised as:

1. participation and reification – the decisions that seek to balance teaching resources and student activities

2. the designed and the emergent – the decisions that seek to balance the prescriptive and emergent elements

3. the local and the global – the decisions that seek to balance local educational experiences with other wider experiences

4. identification and negotiability – the decisions that seek to balance participation and compliance.

The first dimension is the duality of participation and reification; it reflects the interplay of participation and engagement with others and reification through abstraction or conceptual modelling. The first duality reflects the design decisions involved to balance participation and reification. This duality asserts that a productive balance of student activity (participation) and the curricula, plans, resources and individuals (reifications) is needed. It brings into focus those decisions connected to the structure: the balance between contextualised and theoretical knowledge, the balance between students and their tutor in terms of initiative and authority and the timing of the involvement of others. This encourages an emphasis on meaningful activity structured around appropriate resources rather than taking curricula content as the starting point (Brosnan and Burgess, 2003).

The second duality (designed/emergent), asserts that learning emerges in response to a design and helps to explain the intended and unintended dimensions of teaching and learning. This duality reflects the design decisions to balance the prescriptive parts with the need to provide space to enable participants to translate the design in ways that are meaningful to them or 'communal responses' (Wenger, 1998, p. 233); that a robust design has an opportunistic side. It is worth noting, that the features of the designed/emergent duality parallel the previous (reification/participation) duality: that which is designed is reified, and that which emerges is participatory.

The third duality (local / global) recognises that communities cannot be sustained if they remain isolated from wider issues. This duality reflects the design decisions to connect local experiences with broader issues and to theoretical conceptualisations. Wenger cautions against adopting a traditional approach that tends to be overly generalised:

> *If… practices become self-contained they cease to point anywhere beyond themselves. … While training focuses on specific practices, education has a broader scope. … The traditional approach to this conundrum is*

> *informational: to seek generality in more abstract formulations that have a wider range of applicability and subsume other practices under overarching, self-contained educational program (Wenger,1998, pp. 267 – 268).*

The portrayal of the learning environment within university as 'offering a place of play and experimentation, protecting them [the students] from the world whilst preparing them for it' (Orr and Shreeve, 2018, p. 151) articulates the balance most tutors strive to achieve that is encapsulated in this duality.

The fourth dimension (identification/negotiability) draws on the notions of identification and negotiability within the theory of communities of practice, where Wenger (1998) defines learning as that which 'changes who we are by changing our ability to participate, to belong, to negotiate meaning' (1998. p. 226), thus learning involves associations (identification) alongside our capacity to influence the meanings of these associations (negotiability). The degree of negotiability to adapt and interpret the design is an important aspect of design considerations to support new forms of identity through meaningful forms of membership and empowering forms of ownership of meaning. Wenger states that the 'design for learning… must set up a framework, but it depends on this framework be negotiable in practice' (Wenger, 1998, p. 235). The core design consideration here is: to whom and in which ways does the design represents an opportunity to open up new trajectories of participation and build an identity of participation. Without a sense of negotiability, the possible implication is marginalisation, non-participation or passive compliance of participants. Wenger (1998, p. 132) warns that without due consideration of the degree of negotiability, learning will be identical to 'reproduction'. There is some alignment in this concern with the view of Wheelahan (2010) that some vocational education has been reduced to a superficial performance of skills that deny students access to theoretical knowledge that would support critical practice to develop. This serves as a reminder that the intention of design higher education is to develop individuals capable of developing and extending practice not trained individuals capable of precisely replicating current practice (Orr and Shreeve, 2018, p. 151).

Wenger affirms that in order to support the formation of learning communities, the challenge of design is to support the work of the three infrastructures of learning also termed modes of belonging: engagement, imagination and alignment or more fully through:

1. *places of engagement,*

2. materials and experiences with which to build an image of the world and themselves,

3. ways of having an effect on the world and making their actions matter (Wenger, 1998, p. 271)

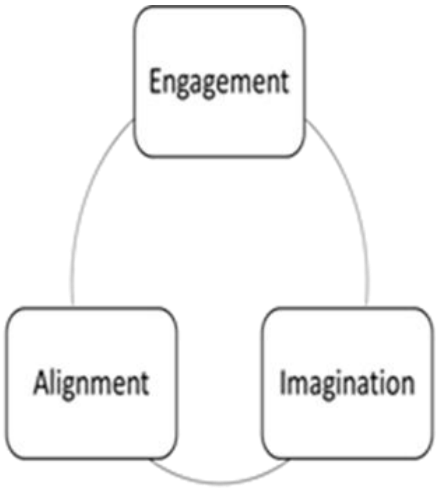


Figure 4.10 The three modes of belonging (Wenger, 1998, p.148)

To make sense of these processes of identity formation within a learning community Wenger (1998, p. 174) proposes that three distinct modes of belonging: engagement, imagination and alignment are considered as sources of identity as illustrated in figure 4.10. Accordingly, engagement is the initial source of identity through practice, imagination then expands the scope of reality and identity beyond engagement whereas alignment is an important aspect that relates to power and our ability to connect and contribute within broader enterprises.

The learning architecture provides a conceptual model for analysing learning among members of communities of practice. It provides the ability to ask how design addresses the four dimensions and provides facilities support engagement, imagination and alignment (Wenger, 1998 p. 239) and can therefore be applied as an analytical tool to examine learning in this thesis. Furthermore, Wenger uses the framework of the three modes of belonging and of learning communities to discuss education as a process able to influence and change the community through the mutual development of individuals and the community that it is 'an investment of a community and its own future, not as reproduction of the past through cultural transmission but is the formation of new identities that can take

its history of learning forward' (Wenger, 1998, p. 263) which provide a mechanism to discuss change more fully.

4.7.2 Analysis process

The initial intention for the analysis stage was to develop the code inductively and to use NVivo to manage the data, manage ideas and query the data (Bazeley and Jackson, 2013, p. 3). Training to use the NVivo software tool from QSR International was undertaken and experience gained during the scoping activities of this study as discussed in section 3.1. Nvivo provides a set of tools to support the efficient analysis of diverse data. As depicted in appendix 13, the data collected through the teaching sessions and subsequent discussions generated 'mountains of words' (Johnson, Dunlap and Benoit, 2010). However, this large volume of unstructured data became very familiar due to frequent access. As shown in figure 4.11, the videos were reviewed to allow for first thoughts to be noted. This was repeated during the process of transcription. Through these review stages, themes were beginning to emerge: inductive or data-driven thematic codes (Boyatzis, 1998, p. 29). Having begun to generate some initial analysis it became clear that the dimensions and components of Wenger's learning architecture were a close representation of the emerging themes. Reviewing how other researchers (Brosnan and Burgess, 2002; Cousin and Deepwell 2005; Lees and Meyer, 2011; Scanlan, 2013; Sorensen and Murchú, 2004; Tummons, 2014, 2018; Waycott, Thompson, Sheard and Clerehan, 2017) had applied the learning architecture approach confirmed the decision to adopt a theory-driven code. The themes generated from the data pertaining to the design and behaviours of the learning community were reclassified using codes from the learning architecture's design dimensions and components which helped to bring organization to the mass of data. Further, it was considered the learning architecture helped support the credibility of the categories. The dualities of the learning architecture explained how the students were apprenticed in industry practice within the community of earning and how it gave them more agency.

Figure 4.11 Initial notes from reviewing the videos

4.7.3 Alternative analysis options

Practice theories are making contributions to contemporary understandings and the processes of social change (Shove, Pantzar and Watson, 2012). Although the 'practice turn' was explicitly identified in the book *The Practice Turn in Contemporary Theory* (Schatzki, Knorr-Cetina, and Savigny, 2001), social theorists agree that there is no unified 'practice theory' but a diversity of theorists who have adopted a 'practice approach' in order to understand the contribution of social processes within social structures, requiring actions to be fully understood within their specific contexts. According to Trowler (2014) social theory has six key characteristics, each enabling a particular function, these are: classification; depiction; explanation; prediction; contextualisation and guidance. Given the focus of this thesis was learning and professional development, communities of practice has been adopted. Two other theoretical approaches, with more emphasis on change were initially considered and are briefly discussed below.

It had been initially planned to use Kemmis et al. (2014) twin concepts of 'practice architectures' and 'ecologies of practices' as illustrated in figure 4.12 to analyse the changes within the community of learning. The theory of ecology of practices illuminates that the five practices of education: student learning, teaching, professional learning, leading, and researching are interdependent. The idea is that target practices can be considered sequentially and systematically and how they may have been shaped by other practices. The table of invention for analysing practices as 'sayings, doings and relatings' (Kemmis et al., 2014, p. 39) was initially considered a useful system of analysis. Kemmis et al. argue that practice cannot be transformed without recognising how they are held in place by existing arrangements (2014). Consequently, it is argued for change to occur it needs to happen across these five practices, otherwise practices have a tendency to 'snap back'. This approach was only replaced when it was considered that Wenger's learning architectures better illuminated the role of design in supporting the identity work students engage in and this offered more opportunities for transferability of the findings.

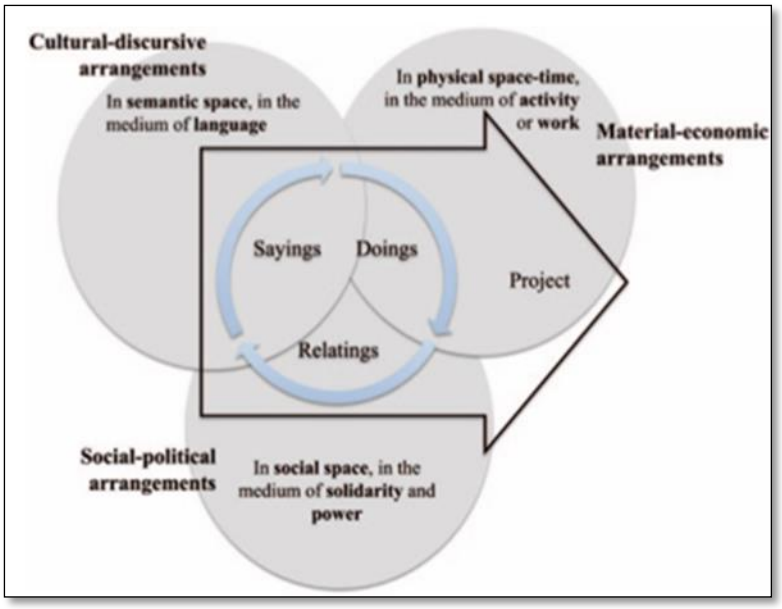


Figure 4.12 The media and spaces in which doings, sayings and relatings exist (Kemmis et al., 2014, p. 34)

The second theoretical framework considered for the analysis was activity theory, specifically Engstrom's expansive learning (1999). Activity theory is another example of social-practice approach and is frequently employed in organisational studies. Expansive learning, in common with situated learning (Lave and Wenger, 1991), is considered to be a collective activity. Activity Theory is considered particularly relevant in situations that have a significant historical and cultural context and where the participants, their purposes and their tools are in a process of rapid and constant change and therefore there was a clear resonance with the learning challenge to be addressed in this intervention - that students go into the industry not just adept at current practice but to be competent and confident to extend the practice (Orr and Shreeve, 2018, p. 151). This approach was seen as particularly useful in understanding the mediating role of the artefact PLM given its focus on human interaction and the use of tools and artefacts. Although Activity Theory offers a constructive way to assess interventions and change it was considered that due to the constraints of formal education, students have little power to 'transform' their practices or to change these external constraints. This power for change rests with academic staff and their praxis in response to feedback, assessment review and external factors which must be then be submitted for approval by the University. This approach would have been adopted if the research topic centred on PLM implementation in the workplace.

4.8 Chapter summary

This study adopted action research in order to understand the students' experiences through the adoption of an intervention based on use of PLM within a fashion business undergraduate course. The chapter has outlined the two phases of the intervention with phase 1: technical phase (May 2014 - February 2015) and phase 2: pedagogic phase (from February 2015). Rich data was collected from the second-year cohort of 2014-15 in the form of videos, interviews and reflective accounts. This was supplemented by interviews with participants of the PLM event week live brief in the final year cohort 2014-15.

This methodology chapter has discussed the philosophical and theoretical orientation of this intervention and associated data collection and analysis processes. The chapter has explained and justified the features of the intervention and the quality of the data and the approach taken to analysis which draw on Wenger's (1998) communities of practice theory. The case for the quality of the data and its robustness to answer the research questions has been made. The analysis summarized in the following three findings chapters utilises Wenger's learning architecture framework derived from communities of practice theory and therefore contributes to knowledge through the application of this theory.

This study represents an example of practitioner action research. The pressures and complexities of the learning challenge is one encountered by all conscientious educators. This thesis is proposed as an example of innovation that also contributes practically to aid others to drive educational change by designing new learning environments that include relevant technologies to support learning as called for by Laurillard (2013).

Chapter 5 Dimensions of the educational design

5.1 Introduction and chapter overview

This chapter draws on the concepts and challenges introduced previously in this thesis. As outlined in chapter two, design pedagogy in a higher education context is closely aligned with the community of practice theory (Wenger, 1998) through a shared significant ontological dimension (Orr and Shreeve, 2018) and intention to support graduates to enter professional practice (Tovey, 2015, p. 48). Traditionally, teaching associated with design pedagogy is predicated on 'learning by doing' (Dewey, 1938, cited in Van Poeck et al., 2018) usually through the simulation of a professional situation via the means of a project brief (Tovey, 2015, p. 3) that can be considered to be the provision of opportunities for legitimate peripheral participation (Lave and Wenger, 1991). As highlighted in chapter three, the literature review, well-prepared professionals are considered to exhibit the competencies and capabilities of being globally aware, having a holistic mind-set, an awareness of sustainable practices and the role of technology as an enabler of change in addition to their discipline-specific knowledge. The central challenge of fashion business education is how to give students a sense of the complex landscape of practice and its histories and interconnections whilst acknowledging that practice is rapidly evolving. This chapter develops the discussion of PLM introduced in chapter three, and argues that because PLM software frames professional practice, it provides a robust means to establish a contemporary community of learning of fashion buying practice through the umbrella of professional activities it supports. This chapter focuses on how PLM was employed to establish a participative learning environment in order to meet this emerging educational challenge and consequently, this chapter focuses on the data from the first teaching and learning cycle of the academic year 2014-2015. This chapter clarifies the practical pedagogic decisions taken during the implementation of the module and analyses it applying Wenger's (1998) learning architecture approach to make the design explicit in order to illustrate the ways students' learning was supported. The chapter illustrates how the design dimensions within framework worked in practice drawing on data from the field notes, surveys and videos to reconstruct the events for reflection. Although Wenger cautions that learning is a response to, not result of, design (Wenger, 1998, p. 225), my reflections consider how the balance within the learning architecture facilitated or inhibited learning and have been woven in to the narrative for the chapter supplemented where relevant from direct quotes from students.

This chapter is structured by taking each of the four design dimensions in turn (figure 4.9) in the thematic analysis of section 5.2 to explore the creative process of designing a learning space in order to illuminate the decision-making process and to demonstrate how the design translated into a learning experience, which is then followed by a discussion in section 5.3 of how the design dimensions articulate with the infrastructural components to build the basis for chapter six.

Chapter six then builds on this discussion in order to apply the infrastructural components to analyse the emergence of a professional identity. In both chapters, the data and analysis are presented through the lens of Wenger's (1998) learning architectures, a design framework for learning derived from his community of practice theory as previously summarized in the methodology chapter (section 4.7.1). Wenger's learning architectures provides a means to use the communities of practice theory within formal education (Tummons, 2018, p. 148).

In summary, Wenger's learning architectures consists of two components: design dimensions, reported in this chapter, and infrastructural components, reported in chapter six.

5.2 Thematic Analysis using the four dimensions of design

5.2.1 Participation and reification

This section argues that PLM represents a new way to reify the buying cycle that invites participation in practice. This intervention has used PLM as a conceptual framework of current practice and as the context for learning. Fashion retail organisations implementing PLM have their processes, communication networks and knowledge topics modelled and this is typically represented as 'the 3P's': processes, people and product data. There is an important distinction between process and practice that is clarified by Greives who prescribes a strategy of moving 'practices to processes by making tacit information explicit' (2006, p. 24). Processes can be fully defined whereas practices require an amount of judgement and experience; moving towards defined processes facilitates automation that then frees up individuals to concentrate on practices (Greives, 2006). PLM is employed by organisations to support these strategic efforts. Although each organisation's internal configuration is unique there are industry commonalties which have evolved to represent an industry 'best practice' template or baseline. Organizations are encouraged to configure rather than customise from this baseline so that software updates can be installed more quickly and at lower cost. This presents an advantage for education in that implementation

has necessitated that processes are made explicit and sequenced rather poorly defined or 'largely intuitive' as identified in industry case studies (Bandinelli et al, 2013 and Vezzetti et al, 2015). Therefore, active participation within a PLM system provides the opportunity to open up the black box of current processes and practices and yield an in-depth understanding. In this way many processes are standardised, defined and made transparent and therefore open to critique. That is not to argue that complex practice can be reduced to a standard procedure but to argue that the challenges of the industry are sufficiently complex without deliberately obscuring processes as a black art by the failure to standardise where possible. It is argued that the standardisation of processes supports the entry and navigation of new-comers, automates some tasks and therefore supports old-timers to work more effectively.

PLM is a multifaceted system and is too complex to navigate without guidance. The teaching resources were constructed from the staff training activities as reported in chapter four (section 4.4.4). The aspiration was to create a participative learning environment that provides for an experience of 'real-life' buying teams and thereby provides for a more active learning experience of buying processes and practices. The step-by-step guidance on how to populate and navigate the PLM system was represented through a pack of instructional guides. These were used to structure and support the associated teaching sessions. The reified output from the learning activities was the production of a 'tech-pack' and this is discussed specifically in section 5.2.3. Learning through participating in PLM shifted learning away from the assimilation of 'know-what' knowledge about the processes of new product development and supply chain management to one of active involvement. In broad terms the four sessions were: library images, sourcing, garment specification and finally, producing a tech-pack.

Through these activities the students navigate the PLM system to populate the library with shared resources before making use of these in seasonal line plans for new products and generate the tech-packs for the planned range:

> *I think the important thing to tell everyone is: use the instructions – [everyone laughs], because if you go in thinking that you know what you're doing you can put everything in the wrong places. The key thing is to understand that the library has to be full before you can use it. You can go into it all excited just wanting to use it (Student comment, video 36).*

The reification of digital technologies such as PLM raises concerns relating to the potential risk in losing know-how that is deeply embedded in practice in the process of digitisation

(Beetham and Sharpe, 2013). This is certainly a real risk when technology is learned about in the abstract without reference to its history or development. However, the learning activities of populating the PLM library in order to produce a tech-pack produced many opportunities for learning tacit skills around new product development such as fabric appreciation and the complexities of garment sizing and fit. These encounters also provided rich opportunities for tutors to demonstrate their embedded and practical knowledge. This is discussed further in section 5.2.4.

The associated assessment task is an illustrated report of 5000 words. In this report, students document the processes that build the tech-pack and critically discuss the relationship between new product development, supply chain management, retail and the consumer in relation to industry practice. Therefore, active participation within a PLM system provides the opportunity to encounter current processes and practices, apply knowledge in practice and reflect on this learning. Equally, as discussed fully in the next section, section 5.3.2, the immersive brief of the PLM event week produced significant learning opportunities through the need to produce other reified outputs in addition to the tech-pack, such as the joint presentation to the expert panel. Both these outputs provided a focus for group working and generated many 'real discussions' through the adoption of industry roles to complete the task which is then presented to the expert panel as an example of professional performance. In common with the findings of Lees and Meyer (2011) it can be seen that reified outputs can used be employed to enhance and motivate participative processes. The learning activity of working as a buying team to generate a tech-pack with PLM has supported a rich understanding of industry processes and practices and helped to illuminate the connections to other knowledge topics. This key finding is discussed further in chapter seven, section 7.2.

While producing a 'tech-pack' within a PLM system provides a useful introduction to the working systems and activities of retail buying teams, the 'tech-pack' output still represents existing practice. Therefore, it was necessary to find to a mechanism to acknowledge that practices are continually evolving and prompt inquiries of how future practice might develop. Therefore, the second assessment was an individual case study assessment (5000 words), where students undertook individual research into innovative, strategic and applied opportunities for extended PLM technologies and business process improvements to transform practice through 'lateral branching' (Knorr Cetina, 2006, p. 37). The individual case study provides an opportunity to explore the possibilities of 'next practice' and serves as a counter-balance to the tech-pack that represents existing practice.

Further, as highlighted in the literature review, PLM is based on the philosophy of connectivity (Terzi et al., 2010) and its open infrastructure facilitates an opportunity to represent the dynamic nature of the industry. Consequently, PLM is in the process of constant evolution as illustrated in figure 5.1. Therefore, PLM can be utilised to frame both existing practice and future practice - that is 'as is' with a clear trajectory of future

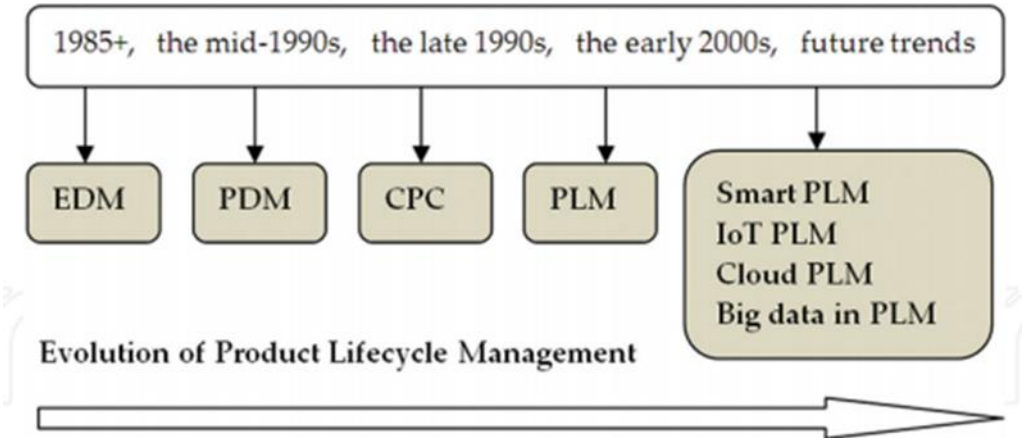


Figure 5.1 The evolution of the concept related to PLM (Udroiu and Bere, 2018)

possibilities 'to be'. Therefore, as the technology continues to evolve it provides a mechanism for educators to stay up to date with industry practice. This is facilitated through the provision of current case studies by the external stakeholders.

The intention of this section was to demonstrate how PLM has been used as a methodology to create a learning environment that encouraged positive engagement with both existing practice and its future development. The balance of participation and reification of the learning design was outlined in order to argue that PLM supports learning by offering a clear map of current processes and practices and invites participation in these. This intervention encouraged participation in the processes of buying teams, a form of legitimate peripheral practice, before encouraging students to consider how these processes might evolve. The intervention initially focused on new product development using PLM to produce a tech-pack mimicking the practices of a buying team. As a result, PLM provided a map of the interconnected practices of the extended enterprise and highlights the need for collaboration. The task of working to generate a bill of materials (BOM) and 'tech-pack' reveals the complexities and interconnectedness of product development and the strategic challenges for organisations better appreciated. Subsequent case study research was designed to prompt a critical perspective of existing practice and how it might develop. Both assessment tasks produce an output that can be described as a boundary object in that it

has a recognised value academically and in the industry. This provided an opportunity for exploration of diverse topics where students might be able to make a contribution thereby bringing some focus to early career plans. The educational partnership for PLM was pivotal in incentivising participation in this new environment and clearly contributed to learning and is discussed specifically in chapter seven. How the design dimension of participation and reification articulates with the modes of engagement is summarised in figure 5.9.

5.2.2 The designed and the emergent

This section illustrates how the balance of the designed and the emergent duality within the learning design was achieved. In terms of design, the resources and methodologies for learning were utilized as described in chapter four. As detailed in chapter one (section 1.4), an educational partnership with the software provider PTC was formed in 2014 and provided access to the industry software FlexPLM. As design considerations pertaining to temporality are not made explicit in Wenger's learning architecture, an account of the management of the educational partnership is reported (Conlon, 2019b) in appendix 15, but the expectation that PLM would be included in teaching in the academic year 2014-15 certainly encouraged a 'just-in-time' mode of working during the first year with reduced opportunities for educational reification resulting in a more responsive approach.

In terms of design, one of the main barriers articulated by PLM software providers regarding its implementation into education is the fact that it is just a system and the host-organization provides the historic and current product data to be managed within this system. Consequently, in a standard industry implementation the data, termed master data, is imported from other systems such as an ERP system. This lack of appropriate master data within the educational setting was seen as a barrier to educational implementation by software companies. One solution proposed was to make a request to use historic data from a retail brand. However, instead of designing out this stage by importing data it was transformed into a learning activity where students populate the library with colours, fabrics, companies and styles. The processes by populating the system longhand, opened up the hidden nature of the tool (Lave and Wenger, 1991, p. 75) through participating in building the data sources in the library. Within a PLM system product information is stored within a central library not held in functional repositories. This is how it contributes to organisational efficiency by reducing wasted time and energy dealing with product information that is siloed, duplicative and inconsistent (Grieves, 2006, p. 71). Some students had initial concerns relating to the visibility of their work as they populated the

library; this is in alignment with the findings of other networked learning (Waycott et al., 2017) although the anonymity of signing in as 'student 1' etc. helped. In subsequent years, the shared resources already in the library made the benefits of an open system more apparent than in this first year. The learning process of adding data longhand actually help students understand the processes and practices and contributed to understanding the significance of the origin of data or its 'where from' (Susi, 2006). The library is a collaboratively filled resource and archive. There was initial some resistance to this in that students felt they should have a degree of exclusive ownership over 'their work' that was reflected in the naming of colours and fabrics in the library. This was explained explicitly: 'the reason it goes in the library is so that we can share it' (Tutor during teaching session) as an important concept related to collaborative working. This can appear repetitive and even pointless but without it the whole system cannot function. This point was reinforced by explaining how it related to graduate jobs. Many of the first jobs upon graduation will be administrative, such as the buying administration assistant (BAA), involving adding updates to the system. Further, the richness of learning the 'longhand' process yields a better appreciation of the automation of administrative tasks that PLM delivers.

> *I think at first, is just getting your head round it, there is so much, so many sections that you have to put separate information in - that's a bit tedious but apart from that once it is in the system, I think it's useful. (Student comment, video 37)*

The significance of the learning potential in this task of populating the library was not recognised at the outset. In the four taught PLM sessions, viewed as an induction course for novices, adding data to the library was originally non-specific– add an image, add a colour, add a material, add a supplier etc. The task was designed to achieve items in the library rather than as a learning activity. Although this takes the student through the process of uploading data, it is much easier to comprehend the process when it is evidently building towards something. The learning significantly increased when the data uploaded had relevance to the student rather than using generic data. Learning was further enhanced when this activity was applied to the activities of a product category team during the PLM event week. This highlights the difficulty for the students to work in a disconnected way from product development i.e. without having first put together a preliminary mood board. After 2015, in subsequent iterations students work off-line in small teams initially to generate a mood board to outline their range plan which they can then upload the constituent parts to the library.

The significance of accurate data within the system and the understanding of where it comes from is a fundamental learning; if the data had been preloaded into the system this essential understanding would have been lost. Potentially, the inner workings of the PLM system would have remained opaque and simply been an alternative representation of the black box of practices. This stage also meant that there was an opportunity for using industry jargon as the students performed the activities mimicking those of a buying team through 'legitimate peripheral practice'. These activities also provided multiple opportunities for the students to use me as a 'learning resource' by clarifying their understandings and sharing my experiences which is discussed in the final section of this chapter section 5.2.4.

The students responded well to the taught sessions and reflected positively in their feedback sheets as shown in figure 5.2. Given these were developed from resources and methodologies that had been used for industry PLM implementations this was expected but not guaranteed given the lower level of work experience. As discussed in the previous section, learning was improved when applied to a task. The surveys taken after the three taught sessions are summarised in the graph below. The survey (appendix 11) utilised the format from organisational implementations where question one relates to teaching materials, question two to the instructor, question four to the learning environment and question five being a summary. Question three is omitted from the data as it is only applicable in industry settings and relates to the additional virtual support of live systems. The section for free comments was most utilised after the first session and comments were constructive in terms of quality of accompanying slide quality, the IT issues and overall pace allowing for these issues to be resolved ahead of the next session.

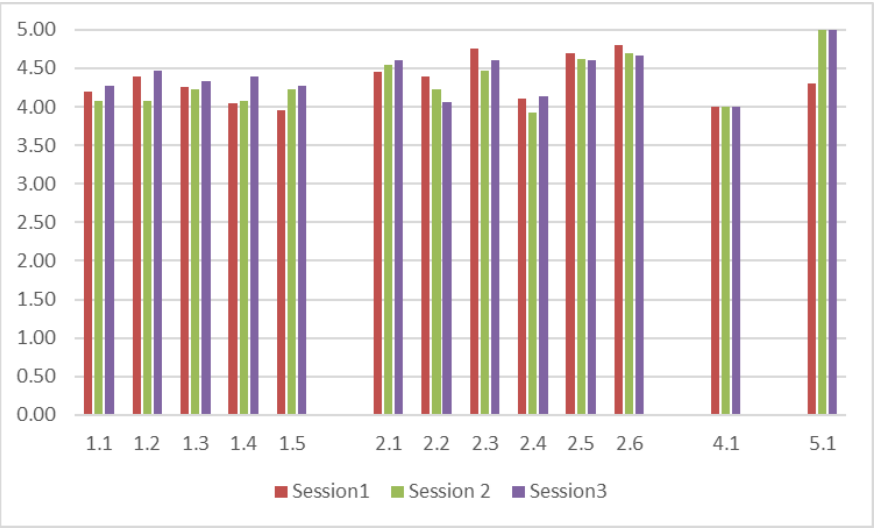


Figure 5.2 Summary of feedback sheets following teaching sessions

The response was also positively to PLM event week as is illustrated in figure 5.3. The final year students had more work experience and the week's activities were enriched through multiple opportunities for sharing these experiences. These vicarious experiences presented the second-year students with diverse resources to begin to perceive possibilities in terms of both work and personal development. The interactions and learning benefits associated with this immersive brief are discussed specifically in chapter six.

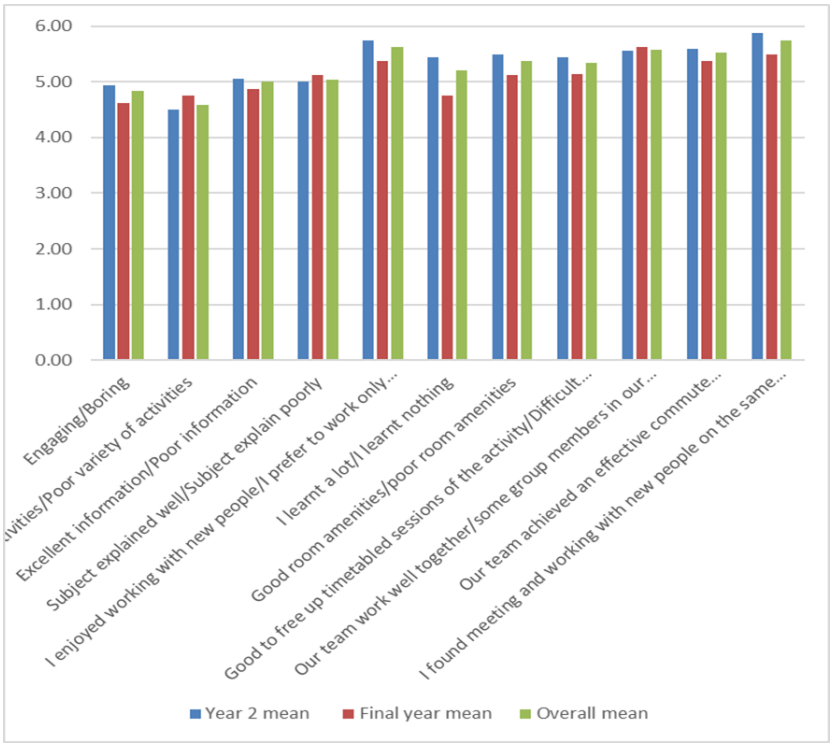


Figure 5.3 Summary of feedback from PLM event week

The experiential learning activities have clearly overcome initial resistance and contributed to a rich understanding of the role of strategic management role of PLM:

> *I was so sceptical of the whole PLM thing towards the start – I thought I don't want to learn this: it looks rubbish! And then I did it and I really, really enjoyed it! [The main part] for me was learning about PLM because I didn't know anything about it and thought it had nothing to do with what I want to do… But now I understand why retailers would use it for management (survey response, PLM event week).*

In summary, the industry model of PLM and its implementation needed significant adaptation given, firstly, the lack of master data within educational contexts and the lower experience of the students. Inputting data into the library proved a useful learning activity

particularly when linked to a specific applied task. Working within the system collaboratively provided many opportunities for students to share their experience and understandings and seek clarification from staff. Making space for the immersive brief in response to interest from the final years significantly enhanced learning and were considered beneficial by both year groups. The impact of this event is discussed further in chapter seven (sections 7.2 and 7.3). The diverse range of interactions that the design created also introduced research interests which were then pursued through case study research as discussed in the next section (section 5.2.2) in support of initial career explorations.

Whilst the partnership brought a sense of urgency and expectation to the design it also contributed and attracted external support which helped to build momentum. Some of the most powerful learning experiences such as the opportunity to learn via the WhichPLM Academy and PLM event week were creative responses generated in response to the urgency in the initial stages of the partnership; I therefore advocate 'messy' live research in this way and urge caution against attempts to further tighten educational reification through imposed, lengthy timeframes for upholding quality criteria; while there is certainly a place for these just as learning cannot be designed only designed for, it can be argued that quality criteria do not guarantee a quality learning experience just an orderly one.

5.2.3 The local and the global

This section reports on the third design dimension, the local/global duality. This duality reflects the design decisions to connect local practices with broader experiences. This intervention has been constructed to use PLM as a framework of buying practices and to involve and utilise industry professionals in the creation of an expanded learning community. However, it recognises that university education is not intended as training for the workplace and the replication of existing practice but as a place of learning that will develop individuals to take the practice forward. This aligns with the assertions of Orr and Shreeve (2018, p. 151) that although vocational education is concerned with the real world, its purpose is learning not the production of artefacts. They argue that this sets up an 'oppositional rhetoric' which the tutor must balance (Orr and Shreeve, 2018, p. 151) that aligns with this duality. Consequently, the learning environment cannot be a precise representation although PLM has been used to create a learning environment that mimics the buying practices of the real world. Further, given that there are so many variations in the practices of associated organisations it is futile to attempt to create a more precise

reality. This point is also made by Wenger: 'no community can fully design for the learning of another' (Wenger, 1998 p. 234). PLM provides a means to organise the interconnections between the educational course and the industry.

The outcomes of the learning activities have been designed to be communication artefacts that facilitate students to demonstrate their competence and potential to the wider industry. An artefact capable of generating meaning in another community, is described as a boundary crossing artefact or boundary object (Star, 1989 cited in Wenger, 1998, p. 106). Wenger (1998 p. 235) and helps develop coherence and alignment between different communities. With the learning design, the purpose of producing boundary objects is to provide the focus to make connections between different practices, provide a framework to align and interpret practice experience and thereby offer the potential to demonstrate competence in the industry; within this intervention the artefacts are the tech-pack and the case study.

The first mediating reification or boundary object of this intervention is the tech-pack. A technical package (tech-pack) consists of the information required by the apparel manufacturer to create the garments and therefore includes all the garment specifications needed for mass production. The technical package is used in the industry to start the manufacturing process without further reference to the design team and in this way the tech-pack brings unity and efficiency to the extended enterprise (Myers-McDevitt, 2011, p. 73). This module is concerned with aspects relating to global sourcing and therefore participating in the creation of a tech-pack is an appropriate activity and outcome and represents the 'as-is' of current practice. As the 'tech-pack' is a recognised form of output in the external industry, demonstrating competence in preparing a tech-pack can be regarded as a representing legitimate peripheral participation in the practices of a buying team.

Tech-packs are a compilation of information relating to new product development and include design specification sheets, fabric and garment specifications and spreadsheets relating to cost and delivery. An advantage that PLM systems bring to the generation of tech-packs is that the information is held centrally termed 'one version of the truth', reducing duplication of effort and costs related to waste from working on out of date information. In this module, the tech-pack has been utilised to provide an experience of global sourcing and supply chain management and functions as a communication artefact. This principle applies equally to a variety of industry activities where PLM could be employed to emphasise another element of practice and provide an educational experience. The role-specific and modular PLM advancements within the software support this approach. Examples of practice that could generate an alternative boundary object are the line plan

and store allocation, or for cost comparison of different sourcing routes or to demonstrate 'what if' material use scenarios to track and trace a component that had perhaps failed testing.

Accordingly, PLM provides the means and context for legitimate peripheral participation. Through the generation of the tech-pack students begin to understand and develop competence in the practices of new product development. By participating in these practices, the learner is also contributing to the reproduction of existing practice. However, the notion of peripheral participation does not necessarily imply reproduction and those at the periphery of practice are exposed to a wide range influences which provide opportunities to modify the ongoing practice. The learning experience of collating a tech-pack within PLM is intended to give a broad experience of the role of members in a retail buying team. It is intended that these interactions support the construction of an experience of meaning from which they can move on to develop individual research interests and a critical perspective of existing practice. By highlighting the normative aspect of practice during participation, students can be alerted to the tendency of practices to preserve the status quo and thereby encouraged to actively engage in reflection and critique of the wider organisational structures within the sector and create potential alternatives.

The case study offers the opportunity to pursue existing or emerging research interests and open up windows of opportunity whilst utilising pre-existing work experience and contacts. It is intended that the completed artefact of the case study whilst being academically accurate also has the potential to contribute to the sector and through this process the students learn to appreciate the value of theoretical knowledge (Orr and Shreeve, 2018, p. 152) and contribute to the increased use of theory in vocational education (Wheelahan, 2010). In this way the activity is deliberately reciprocal as advocated by Wenger (1998, p. 275) that learning communities 'must use the world around them as a learning resource and being a learning resource for the world'.

As discussed in section 5.2.4 and chapter six, external validation has been both a powerful motivation and made a powerful contribution to learning. The signature pedagogy (Shulman, 2005) of design emphasises the element of performance, and therefore it is to be expected that when this 'performance' is validated externally it will have additional impact. Clearly, the educational partnership for PLM was significant in that it provided the opportunity for the learning community to connect with industry as illustrated by figure 5.4. This partnership with PTC led to additional external stakeholders from ITC Infotech, WhichPLM and George all participating in this intervention. This has made the connection to the wider sector more tangible and the activities of legitimate peripheral participation (LPP)

Figure 5.4 Presentation of certificates of participation and WhichPLM Academy bronze award at PLM event week 2015.

more meaningful. The potential of those at the periphery of practice to contribute to the development of future practise is discussed further in chapter seven.

The intention of this section was to illustrate how the balance of local and global aspects within the learning design was achieved. How this design dimension contributes to facilitate the components or modes of belonging: engagement, alignment and imagination is summarised in table 5.1. The numerous high-profile brands investing in technologies such as PLM provides a means to highlight the extent of strategic change in the sector. The system of industry best practice that PLM embodies provides a powerful representation of wider practice and the opportunity for legitimate peripheral practice through the generation of a tech-pack. The emergent nature of PLM software can be used to highlight the static nature of traditional practices and the necessity to deliberately review and challenge them utilizing all the resources available to those at the periphery of practice. The academic case study provides an opportunity for students to network, consider existing practice and contribute to the generation of new practices which is discussed further in section 5.2.5.

5.2.4 Identification and negotiability

This section reports on the final design dimension, the identification and negotiability duality. This duality reflects the design decisions that seek to balance participation and compliance. Although formal education does not embody a high degree of negotiability, it is important to design for some degree of openness to enable students to negotiate their own meanings in response to the design that is placed before them; this aspect is reflected in allowing some personalization of and thereby meaning to, the assignment briefs. The

intervention also encouraged students to consider their membership in other communities of practice and to also use their experiences from part-time work, relatives and friends as valuable learning resources. Through the activities in the module, the students working legitimately (as part of the overall design) contributing, in a meaningful way, their own views, knowledge and competence to the collaborative processes and go on through their case study research, to take ownership through identifying a problem to be investigated and discussed. As a consequence, new opportunities and a scope for building identities of participation was developed and each competent performance supported a growing confidence in their further development. As discussed in the previous section, these interactions also expose students to vicarious experiences of other students, staff, external industry professionals as a resource for imagination.

Wenger highlights that a teacher's identity as a participant in industry practice is a powerful teaching asset that should be employed as a resource to learning:

> *This type of lived authenticity brings into the subject matter concerns, sense of purpose, identification and emotion of participation... It is kind of access to experience they need in order to feel connected to the subject matter. This principle suggests that being an active practitioner with an authentic form of participation might be one of the most deeply essential requirements for teaching (Wenger, 1998, pp. 276-277).*

An example of this sharing of experience is illustrated in figures 5.5 and 5.6. In the sessions, the students selected fabrics from a range of physical samples and then entered the specification details into the PLM system. This required the students to recall fabric structures and properties from their foundation year. This clearly needed support and provided the opportunity to express my detailed knowledge and understanding of fabrics, demonstrating how this applied to practice. The fabric samples are donated 'fabric hangers' from industry and therefore contain authentic mill details and country of origin which lead to another discussion on country specialisms which brought the abstract notion of sourcing and supply chains to life. Learning was reinforced by being applied to practice at the local and macro level through these discussions that demonstrates that PLM provides a useful mechanism for educators to use to reinforce learning by coupling their industry experience with the software. PLM provides an environment that facilitates educators to readily share their industry knowledge and how it represents existing practice. Further, as shown in the previous section the intervention configured a learning space where external stakeholders can also contribute their identities as participants to maximise the interactions among

generations and to bring in accountability (Wenger, 1998 p. 276). It is argued that the PLM environment is also supportive of a shift to learning that is more applied and active by making learning more collaborative and participative and integrating experience.

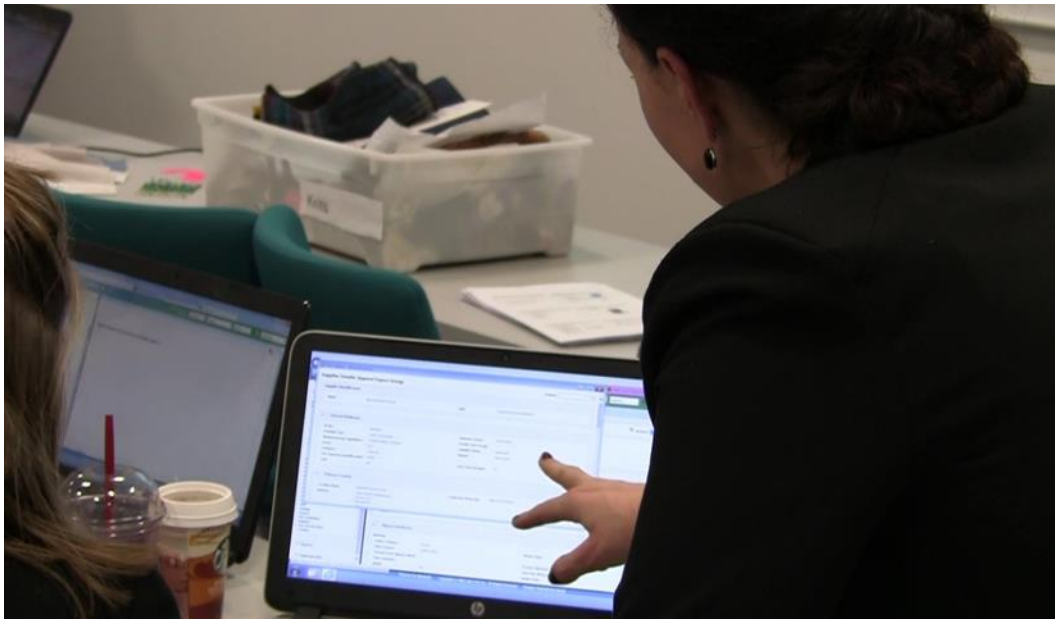


Figure 5.5 Sourcing fabrics and entering specifications into PLM (video 15)

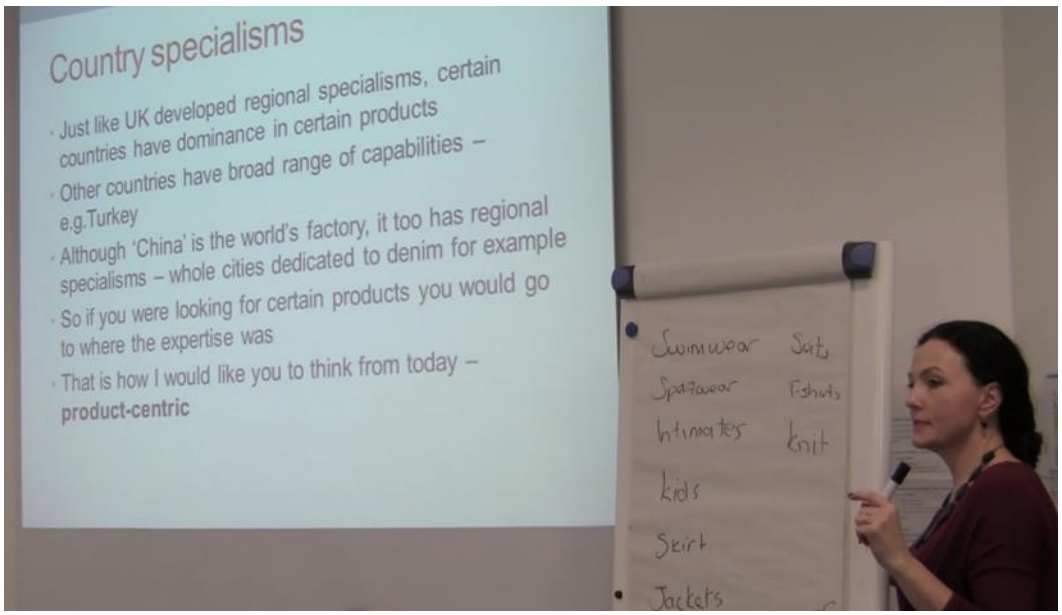


Figure 5.6 Sharing country specialism experience (video 17)

The intention of this section was to illustrate how the duality of imagination and negotiability was balanced of within the learning design was achieved and the main elements are summarised in table 5.1 with the argument developed further in the following chapters. Although working within the constraints of formal education some degree of negotiability is required or the learning would be closer to training than to education. This was an important consideration in the learning design as the learning was not intended to be about learning to navigate and populate a PLM system but to understand the strategic role of enabling technologies within industry and to research into how this might be reflected in future practice.

Accordingly, the collaborative nature of the industry is illustrated by working as a member of a buying team and participating in a key buying task of generating a tech-pack. This gave the students an experience of contributing to a shared output and an insight into collaborative and cooperative working. The shared experiences in completing this activity opened up new possibilities for learning both in discipline learning and in personal development through the vicarious experience of peers, older students, tutors and external speakers. This emerging network of support was frequently accessed for further guidance regarding the case study demonstrating how the PLM learning community began to develop.

5.3 Discussion of the design within the learning architecture

The main features of how the design supported learning are summarised in table 5.1. This table seeks to provide a framework of how the design serves the different requirements of the learning architecture and thereby illustrate how each dimension was addressed in order to facilitate the components or modes of belonging: engagement, alignment and imagination. It is argued that the design provides several and diverse opportunities for many modes of belonging which are discussed more fully in the next chapter (chapter six). Table 5.1 is not intended to be a systematic and prescriptive model for the creation of a community of learning or for PLM implementation within fashion business studies but rather to clarify the factors that the author considers contributed to the effectiveness of this intervention. The contributing factors pertaining to the design are summarised below, but as Wenger cautions:

> *A learning architecture is not a new classification system for existing facilities… The point is rather to provide a framework to ask how a specific design…serves the different requirements of the learning architecture… and provides new ways to think about them (Wenger, 1998, p. 240).*

As with any intervention, the student's participation and engagement was not guaranteed. Additionally, given the low level of knowledge about PLM in the sector this was potentially made more difficult with only a few students having an interest in operational management and technology. The educational partnership for PLM has contributed significantly to the development of a community of learning. Pivotal in incentivising participation in the topic and PLM event week were the sessions given by the external stakeholders. The students clearly responded to the authority and insight of these industry voices. This enthusiasm for the topic could then be channelled into critical and academic investigation. The opportunity to be a member of a small team working within a PLM system mimicking the practices of a product category buying team provided the opportunity to engage with industry practice with their peers and to demonstrate the competence through presentation of their range proposal. The first outcome or artefact in this intervention was the tech-pack, which is also a boundary object. The value of such artefacts is that they have a perceived value outside of education and provides an opportunity to articulate competence at interview, students are incentivised further to participate. These interactions provide opportunities for sharing experiences that appear to spark the imagination to explore future possibilities both in terms of academic study and professional development and network building. The industry voices were able to demonstrate the role of PLM as an internationally recognised strategy being adopted by many prestigious brands; the WhichPLM Academy accreditation provided the opportunity to claim a validation of PLM knowledge from the wider industry alongside academic achievements. It is argued that given PLM software frames professional practice it provides a robust means to establish a community of learning of fashion buying practice through the umbrella of professional practices it supports and the opportunities it suggests. The educational partnership with PTC facilitated access to and contributions from industry specialists at PTC, ITC Infotech and many associated prestigious brands. PLM has an intrinsic openness that allows for changes in emphasis and direction to be easily integrated into the overall design which have occurred naturally in the subsequent iterations.

Today's practice in PLM is very much at the new product development stage, accordingly the tech-pack is an appropriate representation of current practice and facilitates an industry recognised artefact to demonstrate legitimate peripheral practice (LPP) and competence. The individual case study follows on from the team activities and strives to encourage using PLM as an 'imaginary artefact' to imagine a vision of the future and the significance of new tools in organisations (Engeström, 1990, cited in Susi, 2006) where the students to consider what PLM next practice might look like. The aim of this part of the intervention is twofold: to balance the tension between the real world and academic studies inherent in vocational

Table 5.1 Articulating components and dimensions (adapted from Wenger, 1998, p. 240)

Dimension	**Engagement**	**Imagination**	**Alignment**
Participation/reification	Getting involved and persisting to deliver an outcome (tech pack, case study) Recognising the transferrable value of such artefacts to demonstrate competence and potential contribution at interview	Sharing experiences (students, tutors and external speakers) Exploring possibilities (case study) envisioning a future based on a complex composite trajectory compiled from observations and experiences	Recognising PLM as an international strategic tool for business improvement (certification from event and WhichPLM Academy) Appreciation of brokers Efforts to deliberately building a network
Designed/emergent	Places for engagement (structured and unstructured) for membership of a product category team presenting to the external panel The collaborative "team" element of delivering an outcome Significance of open/non-	Multiple interactions and experiences and resources to build a self-image as a professional and associate this to the world of work The need for a means to contrast in order to perceive new possibilities for self and work	Ways of having an effect on the world WhichPLM Academy external accreditation Near peer interaction Realignment through placement or work experience

	timetabled events around an immersive brief		
Local/global	Recognition of transferable principles Networking Using peripheral perspective as a bridge to the wider community	Field trips (PV, exhibitions) Representations of current practice through guest speakers PLM as a conceptual framework to map the industry Using challenges and observations from work experience to ponder potential solutions	Shared infrastructure with numerous high-profile brands investing in PLM Valuing the contribution of a fashion industry perspective in such IT investments Brokers
Imagination/negotiation	Shared experience of production Recognising the value and benefits of cooperation and collaboration Incentivised by the visible difference of near peers	Role models New trajectories Sharing experiences and accounts	Give voice to peripheral wisdom to demonstrate competence and contribution at interview Securing primary research contacts

courses and to demonstrate the contribution of academic knowledge in developing practice and critical practice to develop (Orr and Shreeve, 2018, p. 152) whilst encouraging the students to build an industry network. The significance of the interactions among students, alumni and guest speakers is discussed further in chapter seven. Given that PLM adoption in the UK industry is at its early stage 'skilled PLM practice' has not yet been established, there is an opportunity for those at the periphery of practice to contribute positively to a system in its early development and this discussion is expanded in chapters six and seven. It is important that the students have a free choice in their topic for this assignment and are encouraged to bring in their wider experiences and contacts in order to negotiate their own meanings and identities. The case study encourages the students to use the insights from their peripheral perspective in original research that can further demonstrate their competence and potential to contribute to the industry.

Finally, in a previous paper about the intervention I wrote about some pragmatic details (Conlon, 2019b) in appendix 15 has some practical conclusions which are worthy of summarising here. As with any major intervention the appointment of project lead is recommended who can establish a shared vision for the outcome of this project. Further, the data suggests that this role requires the experience of a boundary spanner, individuals who are well connected internally and externally, emphasising the significance of people in the PLM triumvirate of product, process and people. The project team needs to understand the typical time period of PLM implementations and their open-ended nature. It is recommended that this is a cross functional team and includes other academics, students and IT and reports regularly to a member of the senior management team. It is important to emphasise the significance of including IT. Sadly, universities are prime cyber-attack targets and firewalls are in place to provide security and therefore IT need to be involved to manage an open experience within PLM. At the time of this implementation (2014), cloud and app versions of retail PLM were not as prevalent as they are today. Accordingly, this project installed PLM to servers held on site. The evolution to hosted (cloud) systems with an open additive 'platform' approach to system architecture seems to offer many benefits in terms of security and also for modular adoption. These modules also facilitate the selection and use of other boundary objects (other than the tech-pack) so that a different emphasis in the use of PLM can be achieved.

5.4 Chapter summary

The chapter has utilised the four dimensions of Wenger's learning architecture to analyse the extent to which the intervention aligns with these principles and to make transparent

the design decisions that were made. The significance of the external partnership to develop the learning community was reported and a more permeable boundary between academia and industry encouraged. The deliberate use of boundary objects as learning outcomes is supportive of this collaborative effort. The opportunity for joint endeavour provided opportunities to expand learning through access to vicarious experiences. The learning activities within PLM are approaches designed to support participants to recontextualise extant knowledge to facilitate the development of practice (Guile, 2010, p. 180) and highlight the potential benefits of fresh perspectives. Accordingly, this chapter is an example of practitioner led experimental innovation as called for by Laurillard (2013).

This chapter has illustrated how Wenger's (1998) learning architectures provides a powerful reflective and analytical tool to clarify the design decisions for external dissemination. This chapter recommends this approach to highlight the conditions that shape learning spaces in alignment with the findings in the extant literature (Brosnan and Burgess,2002; Cousin and Deepwell, 2005; Lees and Meyer, 2011; Scanlan, 2013; Sorensen and Murchú, 2004; Tummons 2014, 2018; Waycott, Thompson, Sheard and Clerehan, 2017) as Wenger asserts: 'those who can understand the informal yet structured, experiential yet social, character of learning – and can translate their insight into designs in the service of learning – will be the architects of our tomorrow' (Wenger, 1998, p. 22).

Chapter 6 Modes of belonging

6.1 Introduction and chapter overview

The analysis in chapter five focused on the first part of Wenger's learning architecture: the four design dimensions, to make transparent the design decisions involved in the use of PLM as a conceptual framework to establish a participative learning environment. This intervention was conceived and created as a space for learning that upholds the inherent values of a design pedagogy – learning through doing alongside peers through learning activities that provide an experience of legitimate participation in industry practice. The design focused on providing participants with varied opportunities for multiple modes of belonging within a community of learning thereby increasing understandings of practice and a sense of identity in relation to this practice. In order to support the formation of learning communities, Wenger affirms that the three modes of belonging or infrastructures of learning: engagement, imagination and alignment are needed or more fully:

1. places of engagement

2. materials and experiences with which to build an image of the world and themselves

3. ways of having an effect on the world and making their actions matter (Wenger, 1998, p. 271).

The way in which the design dimensions articulate with the three modes of belonging was introduced in the previous chapter and summarized in table 5.1. This chapter employs the second part of Wenger's (1998) learning architecture to demonstrate how the design facilitated the three infrastructures of learning to support the work of belonging. This chapter argues that an investment in self is encouraged through providing a series of relevant opportunities and experiences for observation, applying skills, devising solutions and making decisions. Wenger (1998) affirms these modes of belonging are a source of identity and this chapter examines how the three infrastructures of learning enable the work of identity formation. A review of the activities and interactions that each of the modes of belonging typically entail as summarised in figure 6.1. The purpose of discussing learning in terms of these modes of belonging is to focus on supporting the formation of a learning community, and contrasts with the previous chapter which was concerned with delivery of the curriculum. Hence, the chapter considers educational design in terms of the effects on the formation of identities.

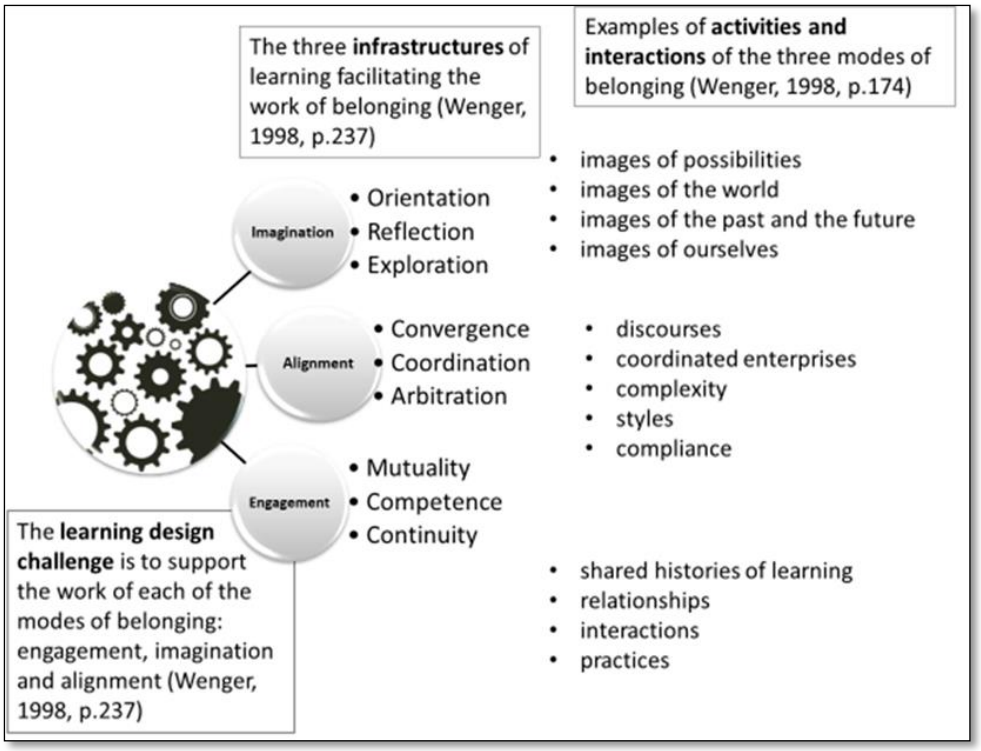


Figure 6.1 The three infrastructures of learning that facilitate belonging to a community of practice or learning (Adapted from Wenger, 1998)

This chapter draws particularly on the voices of the participants termed 'early adopters'. Clearly people will take different things from the range of learning activities and opportunities; this cannot be dictated or predicted, so this chapter explores how these students negotiated the components within the learning environment and found meaning useful in shaping their identities. The discussion tends to foreground the individual experiences of the community, focusing on the significance of the individual within communities of practice (Billett, 2007, p. 55). Appendix 21 includes six vignettes from the early adopter groups.

This chapter proceeds by taking each of the modes of belonging in turn and is presented as follows: section 6.2 contains the infrastructure of engagement: the formation of a learning community of practice through mutuality, competence and continuity; section 6.3 the infrastructure of imagination and the facilities of orientation, reflection and exploration and finally 6.4 the infrastructure of alignment and the mechanisms that connect learning to broader enterprises through the facilities of convergence, coordination and jurisdiction. Section 6.5 includes an adaptation of Wenger's social ecology of identity (Wenger, 1998, page 190) that has been constructed in order to better understand the complex interplay of factors in identity formation within higher education courses relating to fashion business and

those areas where further provision could offer powerful support to identify formation. Section 6.6 summarises chapter and indicates the elements that will be taken forward into chapter 7 for further discussion.

6.2 Facilities of engagement

The first of the three modes of belonging or infrastructural components is learner engagement: the active involvement in the mutual processes towards a negotiation of meaning. The formation of a learning community of practice provides a context for learning that facilitates engagement. Wenger notes that an infrastructure of engagement should include facilities of mutuality, competence and continuity. Examples of the mechanisms for facilitating engagement are shown in table 6.1.

Table 6.1 Illustrative list of the facilities of engagement (Wenger, 1998, p. 237)

Mutuality
1 *interactional facilities*: physical (and virtual) spaces; interactive technologies and communication facilities, time for interaction
2 *joint tasks*: things to do together, availability for help
3 *peripherality* - boundary encounters; ways of belonging to various degrees, peripheral participation, entry points; observation, casual encounters, open houses
Competence
1 *initiative and knowledgeability*: activities that bring about the knowledgeability of engagement; occasions for applying skills devising solutions and making decisions; problems that engage energy, creativity, and inventiveness
2 *accountabilit*y: occasions for exercising judgement and for mutual evaluation; recognisable style; negotiation of joint enterprises
3 *tools*: artefacts that support competence; discourses, terms and concepts; delegation facilities (e.g. automation that allows practitioners to focus on more meaningful tasks)
Continuity
1 *reificative memory*: repositories of information, documentation, and tracking; retrieval mechanisms
2 *participative memory*: generational encounters, apprenticeship systems; paradigmatic trajectories; storytelling

6.2.1 Engagement: Mutuality

As indicated in table 6.1, mutuality is secured by interactivity, shared learning tasks and opportunities for peripheral participation. How this was achieved within the 'PLM learning community' was previously described in chapter five. Although the entire intervention

changed the teaching and learning approach for a 40-credit module, some of the major learning experiences were optional: the immersive brief of the optional PLM event week and the external study through the WhichPLM Academy. Notable in these two elements is the significant blurring of the boundaries of conventional higher education. Both provide interaction between students from two cohorts, tutors and external experts. There was sense that these opportunities were unique and this encouraged participation, made the learning community more apparent and focused attention on the task. The enthusiasm of the final years to complete the range proposal professionally positively reinforced mutuality:

> *I remember them being really driven. We had our own Facebook page! We had a group and were posting on it at night - like have you done this? I think it was motivating at the same time, it made you get your work done. (Liam, second year in 2015)*

6.2.2 Engagement: Competence

As indicated in table 6.1, competence is secured by opportunities and activities for applying skills, energy and creative activity with a sense of mutual accountability through utilising the tools and artefacts of practice. Through working as a member of a product category team during PLM event week the students also had the opportunity to share their experience which is an important feature in an effective learning community as it provides a rich resource for personal development. Design pedagogy seeks to provide a series of tasks for students that require them to learn how to organise their own behaviour such that it produces a competent performance. The interaction with another year group, tutors and external speakers enriches this experience by providing a source to assess professional development through comparison to others experiences. The acknowledgement of competence from the external contacts was recalled as a powerful confirmation by the students. It is interesting to note that although the panel commented that they could not discern an obvious difference between the final year and second year students during their presentations, it was a notable and significant difference for the second years. The correct use of the language of practice i.e. its jargon was seen as a clear indicator of competence as made apparent in this discussion during the debrief session for the second years (video 26). It also demonstrates an awareness that further work experience will contribute to develop their practical skills, that learning is not restricted to formal education:

> *Y2 student 1: 'Why do they seem know loads more than us? They use words we've never even heard of! You feel like you should know it but you*

don't - I don't think I am ready for final year. I feel they're much more advanced - I can't imagine us being like them.'

Y2 student 2: 'I do think it must be from placement. It's not like they've had anything different from us.'

Y2 student 3: 'Yes – and they are most of the way through final year too.' (second year debrief session)

It is perhaps inevitable given the pressure on students to find good quality employment upon graduation that they seek means to differentiate themselves in competitive job markets by seeking ways to actively demonstrate their competence through their CV and interview. Some students clearly recognised the strategic advantage of signalling PLM knowledge on their CVs. This demonstrates that the students recognise a new reality emerging in the industry that offers an opportunity for them in the future careers. Although this may seem a tactical or even superficial reason for participation, it can also be seen as a useful starting point. The comments from Gayle also powerfully illustrate the low value she sees in her student status when entering placement:

I think is a very good idea I think it's great particularly for those planning to going on placement and starting in first year. They will know exactly the software being used in industry. Coming in as a placement [student] you don't have a lot to offer but if you knew how to use the systems, you'd have a head start on those already working in those teams, they might take students from our uni compared to a uni that aren't using this kind software (Gayle, final year in 2015).

Both Gemma and Karen appear to draw confidence from the skills they have developed and both highlight the importance of external accreditation from the WhichPLM Academy. Gemma sees the advantage in being able to demonstrate that she has invested in her own development, seeing the external validation as a means to enable her to demonstrate the effort behind the commitment she has made:

Yes, it's on my CV [in response to being asked about importance of external accreditation from the WhichPLM Academy]. Nobody has mentioned it when speaking to me but I do think that it helps. It is in the skills section rather than experience section so it's another thing, it makes you look more rounded. it's better, because you have done in your own time, you've gone out of your way. At a few interviews, people have asked

whether we did at uni or did the University encourage that, so they do ask those sorts of questions. It's good to not be solely university-based. It's optional like you said so you have the choice of doing it (Jemma, second year in 2015).

Karen has also promoted this external qualification (figure 6.2) and recalls the interest and further questions that this has brought:

I've got it on my LinkedIn and have been asked by people what is it, blah blah blah, and they seem really interested in it and that you have that knowledge. (Karen, second year in 2015).

Figure 6.2 Some of the first students to achieve WhichPLM bronze award

6.2.3 Engagement: continuity

As indicated in table 6.1, continuity is secured by two forms of memory: reificative, in the form of repositories of information and participative, in the form of shared encounters across the generations and storytelling. Even within this 40-credit module, time is limited and insufficient to develop a true sense of the long-standing shared repertoire and associated history that define a shared history and repertoire of a community of practice. However, it is argued here that a sense of continuity was achieved in this intervention through the 'reificative memory' of the PLM system and the intensity of experience of the

immersive brief as outlined in chapter five. The 'reificative memory' of PLM arises from both its overall framework of routinised practice and though its library access to shared resources such as colours, fabrics, supplier. As discussed in chapter five, initially some students were reticent about the open nature of this collaborative space or parochial in regard to their contribution, indicating that open sharing and visibility within education are unfamiliar and therefore how to work collaboratively and its benefits need to be made explicit. Whereas, participative memory relates to combining two cohorts from different years into mixed product category teams to establish an apprenticeship system. The paradigmatic trajectories (visible career paths) that were made available from working with different year groups is discussed specifically in chapter seven as this had a profound impact. As noted by Cousin and Deepwell (2005), the closed nature of conventional learning groups inhibits this opportunity to learn reciprocally through challenge, questioning and sharing experience. Generational encounters are facilitated by using the industry experience of tutors as a resource for teaching and learning. It is difficult to make a clear definition between generational encounters and brokers. The definition used here is that those within the community of another generation i.e. tutors are discussed under generational encounters whereas those external to the University i.e. visiting lecturers are defined at brokers and discussed in section 6.4 (alignment). This extends the discussion presented in section 5.2.4 where sharing work experiences with students enabled practice to be brought to life and demonstrated the thought processes of a practitioner.

6.3 Facilities of imagination

Engagement through participation in the community of practice is only one element of modes of belonging. Although it is important that students can participate in current practice, there is a need to understand the history that led to this 'as-is' state and to consider how practice may evolve in the future. This is particularly relevant within a dynamic industry like fashion business where practices are transforming rapidly. Wenger (1998) argues that engagement alone offers only a limited opportunity for learning:

> *The possibility of engagement is critical to learning, but it can be narrow. Although communities of practice are places of learning, the learning they enable does not necessarily include expansive images of history, possibilities or of concept systems writ large. It takes imagination in order for learning to encompass and deal with the broader context. Towards the*

end, an infrastructure of imagination should include facilities of orientation, reflection and exploration (Wenger, 1998, p. 238).

Table 6.2 Illustrative list of the facilities of imagination (Wenger, 1998, p. 238)

Orientation
1 *location in space*: reification of constellations; maps and other visualisation tools, open spaces
2 *location in time*: long-term trajectories, lore, museums
3 *location in meaning*: explanation stories examples
4 *location in power*: organisational charts, process transparency
Reflection – models and representations of patterns; facilities for comparison with other practices; retreats, time off, conversations, sabbaticals and other breaks in rhythm
Exploration – opportunities and tools for trying things out; envisioning possible futures and possible trajectories; creating alternative scenarios, pushing boundaries, prototypes; play and simulations

The second of the three infrastructural components is imagination. The role of imagination is to extend the scope beyond engagement and to open up different images of future-self and future-practice. Without imagination, the practices could become self-validating, merely mimicking the processes and practices of a community of practice in a way that could potentially be considered to be technical training. It is important that these processes are made open for challenge and critique in order for practice to develop. Wenger notes that an infrastructure of imagination should include facilities of orientation, relocation and exploration. Examples of the mechanisms for facilitating imagination are shown in table 6.2.

6.3.1 Imagination: Orientation

As indicated in table 6.2, orientation involves the mechanisms that are at play as we locate ourselves in the world, the mechanisms of space, time, meaning and power. The visual image of PLM (figure 6.3) has provided a powerful conceptual framework since the redesign in 2011 (Conlon and Taylor, 2012) and the subsequent PLM implementation in 2015. It has been valuable to the course team to agree priorities of the implementation (section 4.4.5) and as a mechanism to guide the sequencing of learning activities. For the tutors on the course, the image was powerful tool of orientation in space (the industry), time (indicating the trajectory of past, present and future), meaning (exemplar industry case studies) and power (offering the means for process transparency and thereby industry change).

Figure 6.3 Visual depiction of PLM used as a conceptual framework within the module redesign (TXTgroup.com, n.d)

Accordingly, this has been shared with the students in the accompanying course materials in order to communicate the extent of industry change whilst mapping the supporting processes. The significance of the visualization was not apparent to the students. There was a clear gap between what was intended and how it was experienced. It appears that without a means of contrast (from work experience or traditional depictions of the buying cycle), the provided representation of PLM was unproductive and redundant without a meaningful understanding of what PLM was **for**:

> *I don't remember anything about PLM in the second year but I do remember working with the other courses… I don't remember it structured in that way. Probably because I had no idea what PLM was at the time? (Gayle, final year in 2015)*

> *I remember the reference; I remember the diagram but that's all I remember. I thought it was more of a process, I hadn't seen it as a software system. (Nadine, final year in 2015)*

I guess I knew what PLM was already but didn't know what it was for.
(Caitlin, final year in 2015)

Although it had been intended as a tool to support navigation of current and future practice, its significance had clearly remained obscure. The learning impact appears to have been lost, that rather than a tool it was an abstract concept and just another topic on the curriculum. This can be contrasted against the findings in section 6.3.3 imagination: exploration. Here, through an experience in the learning community, PLM is more fully understood as a tool of strategic industry change. This also resonates with the findings in chapter five that the learning was more apparent if applied to fulfil a task.

6.3.2 Imagination: Reflection

As indicated in table 6.2, through reflection we can recognise in our own experience broader patterns, influences and arrangements that is secured by facilities for comparison with other practices. The significance of facilities for comparison to with other practices is emphasised here as it is seen as essential as it provides the basis for emerging reflective practice. It is argued that students need a means to understand where the benchmark for best industry practice currently exists. As consumers this generation have come to expect fast-paced, intuitive solutions. However, this may not be provided in the standard workplace and without work experience this cannot be known or understood potentially resulting in frustration. This frustration was articulated during the data entry part discussed in chapter five, section 5.2.3. Even working in a world-class system, the students can be frustrated by the numerous steps and effort required in standard processes, succinctly expressed through the plaintive question: 'Isn't there an app for that?'. The final year students were asked to advise on their previous learning experience, or curriculum as experienced (Billett, 2015, p. 187), such that persistence and participation with PLM could be better encouraged and supported.

For the majority of students in their final year in 2015 the facilities for comparison were provided through a placement year and ongoing part-time work in retail. It was this exposure to current business practice that provided the means for them to see the strategic role of PLM in industry change that we had hoped would be evident form the conceptual framework image as discussed above. Although this does contribute positively in many ways, it can encourage a strategic perspective to academic studies. However, through work experience, these students were more aware of the significance of the digital transformation of the industry and offered the following advice to younger students:

I think to understand that you not going to grasp it straightaway. In industry you're thrown in the deep end and expected to know everything. But you are only at university and there to learn. And there are lots of people to help you. If you're trying with the system – not brushing it off treating it as another piece of work, that this is something that you will use in the industry, something this real-life. Some of the assignments have a ***limited payback*** *you might use it or you might not. Whereas if you are going into a business that is using a PLM - if you are looking to go into the retail industry more likely than not you will encounter a PLM system, then you should take your time with it and fully understand the concept and understand and learn it. Pushing themselves, not just looking at one part - see what else it can do, what else can the other systems do. Ask more questions (Gayle, final year in 2015).*

Some of the students had returned from placement with exposure to enterprise systems that prompted an interest in how technology can achieve process improvement:

I definitely think PLM is important - from my experience at [placement provider/retail brand] we had so many different systems, we had constantly to check the different ones, go to our suppliers, the suppliers would get then confused which system they had to check. I think PLM will help the relationship between the two parties, help the business become more streamlined and effective. I think the main problem in retail is getting your products in the right amount at the right time. I think having software with all the information in one place and integrated throughout the business will enable to cut down so much wasted time and money. (Gayle, final year in 2015).

I remember I was telling you about problems on my placement. In my head I was trying to understand how could this have been prevented, what could been put in place and save retailers millions of pounds and that's when you brought PLM software up. And then that's how my research began in PLM… I think that it makes businesses more efficient. It doesn't just solve the critical path it helps to solve everything. It can save a lot of costs. It can improve turnaround by getting that product to market much faster. It can improve communication with suppliers - in industry that can

be so challenging. Everything gets streamlined and standardised in PLM... (Nadine, final year in 2015)

Further, that it has potential for application beyond fashion retailing:

I am so glad you told me about it. Before, I was like freaking out towards the end placement, thinking I don't know what I'm going to do for dissertation, don't know what I'm going to do for final major, and then obviously it helps if they're all linked. I just felt like as I had a detachment from fashion, because I was in beauty for the year, and don't have [fashion experience], I don't know enough about what fashion is all about. Then I remember the class where I told you about it you said about PLM. Having researched that, I realised OMG I can do my case study, my dissertation and my final major on this. Without that I don't even know what I would have done. So, I am very grateful! (Caitlin, final year in 2015)

As shown by the comments of a second year in 2015, she participated out of curiosity for novelty and the external speakers but could later reflect on the relevance and significance:

I found it really interesting because it wasn't something we done on the course before. It was very new at the time. It was good to have people in from the industry. At that point, because it was so new you don't really take it in. You realise how significant it was later. I just remember taking everything in from it. Very different from what I knew before even from my work experience… But from ***seeing how it was in the industry it meant I could compare it****. (Jemma, second year in 2015)*

It is evident that there is a learning benefit by facilitating for the comparison with other practices, that placement or other work experience provide an important source of imagination. However, this them must prompt consideration of how significant it is to provide a point of comparison for students before the opportunity of work experience. This is the role of industry case studies, other stories, shared experiences from guest lecturers and near peers which is discussed further in chapter seven. Through these vicarious experiences it is possible for reflection whilst on placement rather than after it. As Liam comments here, he was able to reflect on the reality of systems at his placement company and compare retrospectively to his academic knowledge:

But going to [placement company] and seeing their systems there, I wasn't surprised to see that there wasn't a PLM system already. Not just because of their brand reputation, well maybe a little bit. Similar ***processes were very long winded and you thought can't you do something?*** *A system that would be simpler and easier. (Liam, second year in 2015)*

6.3.3 Imagination: Exploration

As indicated in table 6.2, exploration involves the opportunities and tools for trying things out; envisaging possible futures and possible trajectories; creating alternative scenarios, pushing boundaries, prototypes; playing simulations.

In chapter five, section 5.2.4, the role of external partners and links to prestigious brands were reported as pivotal in encouraging participation in the change programme and optional activities of PLM event week and the WhichPLM Academy. While these were clearly opportunities and tools to try things out, the emphasis in this section is on a better understanding of what the students felt prompted them to participate and what they thought they would get out of doing so. Students, like Nadine, who had had placement experience to refer to were keen to be involved and have the opportunity to share their insight:

Perhaps focus on the opportunities that PLM is been around for so many years and that it's growing. From my placement I've seen the problems that PLM can solve. That's why it fascinates me. I can see the opportunities. Whereas if you hadn't had that experience it might be difficult. It's hard (laughing)…I think if you see how actual businesses are being affected the amount of money that is being wasted. It is hard compared to learning in the classroom when you can see this in actual business that is affecting and the impact. (Nadine, final year in 2015)

Whilst Liam (second year in 2015) had recognised from the prior lectures and external speakers that this was a change and an opportunity that would affect his future:

I would say purely out of interest really. An excitement of actually going to use the system. Getting the opportunity to do something like that. It's quite a big thing. Especially with the emphasis beforehand about how big

and how much this is going to affect us in the future. It will change roles. I think that was probably the main thing for me (Liam, second year in 2015)

Whereas, Karen recalls being quite compliant, expressing the sense of not wanting to let people down, in terms of the tutors and speakers involved. She also alerts us to the pressures of other assignments and other external activities that challenge participation but that this was overcome by her own intrinsic motivation to learn:

When I was first told, [although] it was interesting I would have thought I'd got too much to do, I would always have done it. I think I was probably just doing what I was told. I can't remember thinking: I really need to do this because it's really important… just not letting anyone down. I would never have been one not to do it. You come to Uni once. You can always learn something. My mum always says that I take too much on but I like being in it. You can always learn something. What else are you going to do? (Karen, second year in 2015)

There is a parallel to be drawn between the pressure to perform at work and the pressure to complete assessments to a high standard that exposes the tension in having assessed tasks associated with this learning experience. While it is not possible to eliminate assessments from the module is important to reflect on the nature of what is being assessed and what activities can be optional. There is a possibility in becoming outcome focused with the production of any final output, even a tech-pack, and this potentially dominates the activity such that it may appear that the purpose is accurate data entry to achieve a final recognised output and consequently obscures the broader skills that are being developed through the process. Jemma was aware of this tension but was able to see the broader benefits:

I'd say it's good for updating your skills on multiple levels. Like the fabric side and the design side you don't really access on the course. Is giving you another skill, broadening you…. I think, I like to do everything I possibly can, but that's me as an individual. I think some people I know that are younger than me just get their head down and do what they're doing, what they've been told to do, and focus on that rather than looking outside. It's not necessarily a bad thing, because you can take on too much. (Jemma, second year student 2015)

6.4 Facilities of alignment

The final infrastructural component is alignment. The work of alignment involves linking the activities of a learning community of practice to the broader, external issues of the industry. This final mode works with engagement and imagination but focuses on the need for learning to have an impact on professional practice:

> *Imagination can open up practices and identities beyond engagement, but it is not necessarily effective in connecting learning to broader enterprises. Through alignment, we can learn to have effects and contribute to tasks that are defined beyond our engagement (Wenger, 1998, p. 238).*

Table 6.3 Illustrative list of the facilities of alignment (Wenger, 1998, p. 239)

Convergence
1 common focus, cause or interest; direction, vision; shared understanding, creed, values, principles
2 allegiance, leadership, sources of inspiration, persuasion
Coordination
1 *standards and methods*: processes, procedures, plans, deadlines, and schedules; divisions of labour; styles and discourses
2 *communication*: information transmission, spread of novelty, renegotiation
3 *boundary facilities:* boundary practices, brokers, boundary objects, support for multi-membership
4 *feedback facilities:* data collection, accounting, measurements
Jurisdiction – policies, contracts due processes; mediation, arbitration, conflict resolution; enforcement, distribution of authority

Wenger claims that in order to make this possible, an infrastructure of alignment should include mechanisms to connect learning to broader enterprises through the facilities of convergence, coordination and jurisdiction. Examples of the mechanisms for facilitating alignment are shown in table 6.3.

6.4.1 Alignment: Convergence

As indicated in table 6.3, convergence is secured through common interests and shared understandings as sources of inspiration. This intervention recognises that there is an

opportunity for convergence between higher education with the growing need for knowledgeable practitioners in the sector. It was a deliberate intention to demonstrate that the rapid change within the industry, due to digitisation, is a potential source of inspiration and an opportunity for graduates. However, this was not intended to be a direct link into PLM specialist roles but a more general recognition of the powerful change that digitisation is bringing about and how to apply this to career self-management. This was confirmed by Caitlin:

> *This is one extra selling point that companies are looking for now. The fact that I've got, that I dealt with two ERP systems and was involved with the implementation of one in my placement, I know because Arcadia have told me, that that was a really strong point on my CV. (Caitlin, final year in 2015)*

Caitlin also highlighted that without an interest in the topic, i.e. without convergence, it was unlikely that digital transformation would become a source of inspiration and therefore potential career opportunities would be missed. As reported in the literature review chapter three, section 3.3.2 there is limited knowledge of enabling digital technologies in education, which is further exasperated by the tension between artistic freedom and commercial awareness. This indicates that higher education courses are not leading the development of practice or responding to the new roles and skills required as a consequence of the digital transformation, leaving undergraduates at risk in competitive job markets (OC&C Insight, 2016).

> *For my report [investigating PLM as a methodology for fashion incubators and start-up accelerators], I did a small focus group with the girls in fashion design. They were also working on their final major and were happy to help. Literally none of them had heard of it [PLM]. I made sure that the focus group of girls had all said that they wanted their own line in the future... Then I was talking to them about where would find your funding for your business, or how would you [initiate a] start-up – would you hire people to manage each function, do you know about these functions, et cetera. The main thing they said was that they didn't know about accelerator programmes. They didn't know that was a means of starting a business. But then that they didn't know about product life-cycle management - at all! When I was saying it to them, they were like 'that makes sense', it must help design through to manufacturing, checking all*

the stuff, that makes sense. They hadn't heard of it at all before. It's hard to say where it should come from, I don't know, I don't know even if it was more publicised say in Drapers whether these girls would have seen it. I don't know. (Caitlin, final year in 2015)

6.4.2 Alignment: Coordination

As indicated in table 6.3, alignment requires the ability to coordinate specific forms of participation and reification to support the common purpose. The facilities of coordination seek to provide many opportunities to connect learning to the broader styles and discourses of the sector. This was facilitated through using PLM as a conceptual framework to map current processes and practices, external speakers to convey examples of innovative practice and future developments whilst also being open to support students' investigations and provide feedback on their efforts, and finally the use of the tech-pack and case study as boundary objects to demonstrate competence at interview. This mix of activities can provide a rich source of information on inspiration:

The WhichPLM [Academy] style of learning was quite good, having lots of external speakers that was good to help you realise the benefits and that you're probably going to be working a company that will be using it has more and more companies adopt it. It is really interesting though. I personally got caught up in it. I do find it really interesting. The sources of information, all the big names linked to it, all the problems. ***It's not just pretend****. I think it's really good about the module. (Nadine, final year in 2015)*

Some students clearly feel confident in their learning and are able to see how it can be leveraged to their advantage at interview:

Obviously [retail brand] are using it at the moment. They were impressed I knew what it was, that I had an interest in it. The buyer had heard about it but the HR lady hadn't. When I explained it further, the buyer didn't know a lot of the benefits, only the base of it, so she seemed to get to know more about it and get more interested in it so that in the end said she would go away and do some more research. (Gayle, final year in 2015)

But as indicated in section 6.3.1, the low-level industry knowledge is a barrier to the students making a positive contribution:

I would like to [pursue an interest in PLM]. This is something that I'd like to speak to somebody about but I need to find my feet first. I wouldn't know where to start to get into a career in this; I personally haven't seen anything advertised. I wouldn't know where to start. (Nadine, final year in 2015)

Having a connection with key industry personnel willing to act as brokers is essential to mediate this barrier to change. The provision of opportunities for students to develop and test their ideas and skills and gain industry insight is invaluable to their learning. These individual and personal connections, where someone takes the time to support students are invaluable and highly appreciated:

I think it was good to hear how about it, what stage they were at with it. How they were finding it. Whether it been introduced across the business. Actually, I interviewed her for one of my projects afterwards on work experience. So very useful. (Jemma, second year in 2015)

The students were particularly to acknowledge the generous contribution of Mark Harrop and the WhichPLM team to this intervention and their learning:

Obviously, his story is very inspiring, he travels the world with his own business giving seminars lectures and talks and yet he comes [here]. I think that has really shaped our learning on PLM. I think it's because he has such passion for this area, can deliver that well to us. (Liam, second year in 2015)

To say somebody who has their own company, is always been willing to come here and teach us…It's a big thing. (Karen, second year in 2015)

All the external stakeholders in this intervention were particularly supportive of the students' own research and this encouraged further networking:

Everyone that you have put me in contact with and that I have contacted about my research have been amazing. Morag, in her interview. Mark just like answering every single email I fired off to him. They've been amazing. I would obviously like to return that when I'm at that point of in my career when I can help. I do feel that that it is rare and they have been amazing so yeah, I'm definitely keeping in contact with them. It has led me in so many different directions – I have a contact the British Fashion Council

now, which is amazing, like Arcadia were impressed that I was doing all this stuff with it. (Caitlin, final year in 2015)

The final year students were also keen to share their experience and supportive of questions from other students:

I had a conversation with [names student from Y2 in product team]. He was asking where I'd been and I explained that at [retail brand] we had four different systems that are all time-consuming! That you had to learn all of them and that none of them were exactly the same. So, to have only had one system that was only time-consuming initially then that it would be a benefit. (Gayle, final year in 2015)

It is clear that the students recognised and valued a particular authority in the voices of these final years in common with industry voices. We have found that our alumni are keen to contribute to the ongoing programme and therefore this is a source of information and connections for the next generation of students that may be more easily and frequently coordinated than other industry experts:

When we did a talk about placements to the first years the other day because they're about to start the summer projects…as soon as [we] started they were all sitting up to attention. I think it's just because they can relate more to us – we said we were you sat there in first year, you can do what we've done. Also, because I know how much you talked about LinkedIn, but first and second years are probably reluctant to add, but [we] were like 'add as on LinkedIn and build your network', I think coming from us they are more inclined to [do it]. I wouldn't have thought in first year that I could have done half the stuff I've done now, that it would have been possible. Some of the things I remember most in first and second year is from the girls coming into talk through their experiences so yes, I think it's a really good idea. Especially when we've got the industry relations and can say when we were at this company how it's done. Yes, good idea and I'm happy to come back and help. (Caitlin, final year in 2015)

6.4.3 Alignment: Jurisdiction

As indicated in table 6.3, alignment requires a mechanism to frame practice and facilitate jurisdiction. Examples of jurisdiction are: policies, contracts, due processes; mediation, arbitration, conflict resolution; enforcement, distribution of authority (Wenger, 1998, p. 239). Clearly, formal education brings with it a standard way of proceeding: attending and completing assignments with formalised procedures for dealing with non-compliance. This can be thought of as 'educational reification' (Sorensen and Murchú, 2004, p. 197). Although, these procedures cannot be ignored, they do hold in place the traditional approach to teaching of individual cognitive acquisition of knowledge. In many ways these thwart attempts to adopt a teaching style of facilitation and participation particularly if this is not consistent across the course. More positively, it can prompt a discussion with the students about different approaches and encourage a toleration of uncertainty and ambiguity. Resources and activities about the 'rules of the game' for effective team working were made explicit and are included in the introduction to the module. The structure of the PLM system consists of well-established processes that are intended to mediate practice, as discussed in section 5.2.2 it is important that these internal and hidden processes are made explicit such that they are open and transparent critique and change.

6.5 The social ecology of an emerging identity within fashion business

The transition through higher education and onto becoming a professional practitioner is shaped by personal, social and environmental factors. Although students need to be agentic and proactive as both students and professionals these attributes need to be developed. Facilities to support the personalization through an awareness of how different components of courses might contribute to their career prospects and development are needed (Billet, 2009, cited in Peach and Gamble, 2011, p. 179). Resources and experiences are also needed to be provided to assist students to successfully make the transition through education and into the workplace. Educators need to become better aware of the facilitating and impeding factors influencing students learning trajectories. Universities can support the development of critical, agentive and self-directed students through approaches to pedagogy and curriculum design that support participative learning (Peach and Gamble, 2011, p. 179). It is argued here that communities of practice and the learning architecture approach derived from it, offer a means of programme review and reflection to better understand and support these learning trajectories such that more students can realize the transformative benefits of higher education beyond qualification:

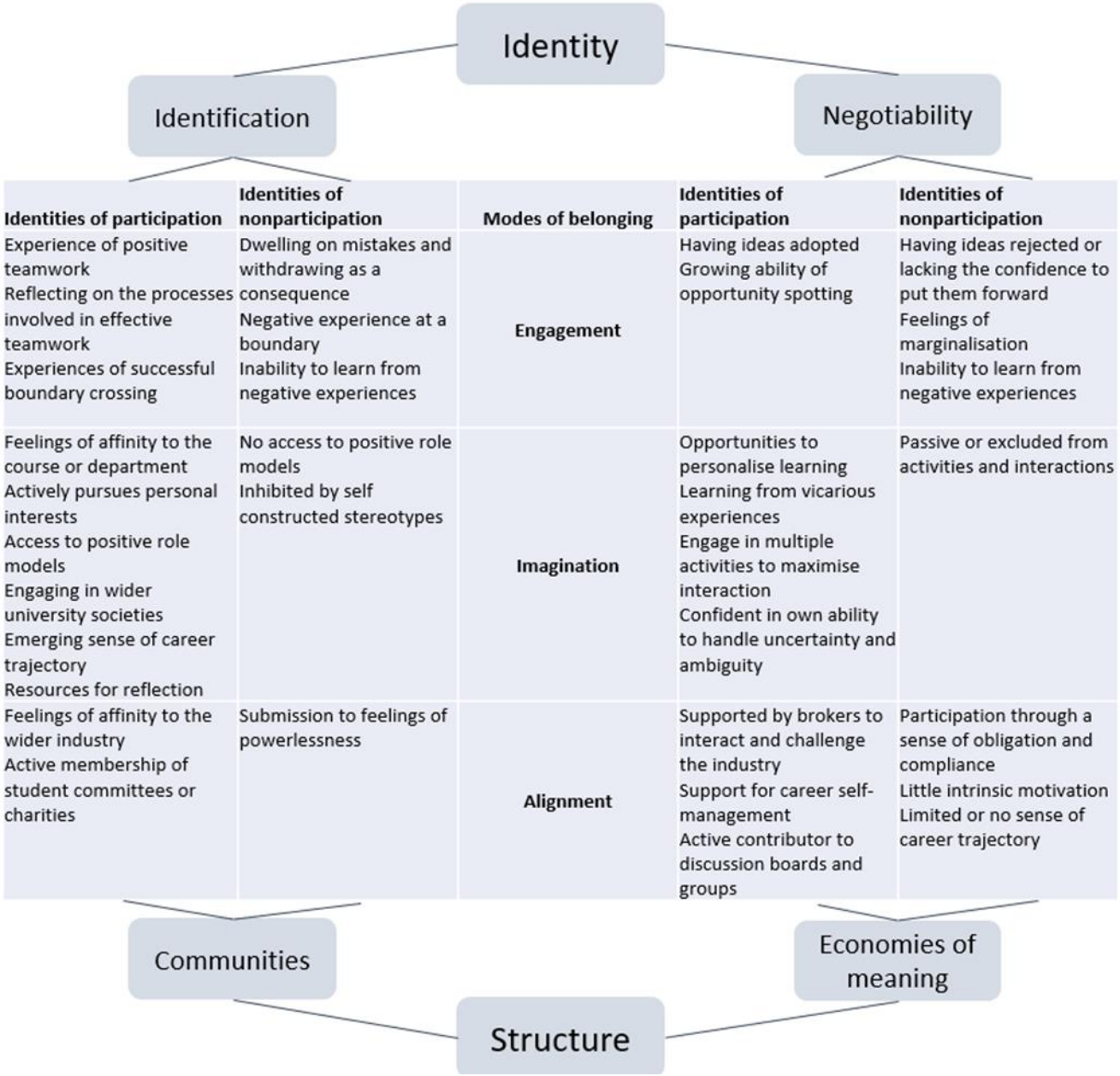
> *Education, in its deepest sense and at whatever age it takes place, concerns the opening of identities – exploring new ways of being that lie beyond our current state. Whereas training aims to create an inbound trajectory targeted at competence in a specific practice, education must strive to open new dimensions for the negotiation of self. It places students on an outbound trajectory towards the broad field possible identities. Education is not merely formative – it is transformative. (Wenger, 1998, p. 263)*

Figure 6.4 has been constructed as an adaptation of Wenger's conceptual social ecology of an identity (Wenger, 1998, p. 190). Identity formation within communities practice theory is conceived as a dual process of identification and negotiability:

> *1. 'Identification is one half of it, providing experiences and materials for building identities through an investment of the self in relations of association and differentiation.*
>
> *2. Negotiability, the other half, is just as fundamental, because it determines the degree to which we have control over the meanings in which we are invested.' (Wenger, 1998, p. 188)*

Communities of practice can be progressive or reproductive depending on the extent to which negotiation is encouraged to allow its members to decide how to participate in the process meaningfully. The mechanisms that have supported allegiance are presented in figure 6.4. Within figure 6.4 each of the components of identification and negotiability is separated into sources of participation and nonparticipation. Wenger takes care to stipulate that the sub-components of participation and nonparticipation are not opposites– this is too simplistic a view (Wenger, 1998, p. 212) and nor are they merely personal choices but illustrate how participation in a community of practice shapes identity. In its construction, figure 6.4 has utilized the data and analysis from chapters five and six and the vignettes of the early adopters (appendix 21) in order to better understand the complex interplay of factors in identity formation within higher education and those areas where support could be improved. Firstly, in terms of identification, the processes of identification through engagement can be positively supported through attention to how teamwork and external networking are provided with approximate level of scaffolding and mechanisms to learn from negative experiences. Identification with the community of practice requires imagination to envision future practice and future self and this can be supported through efforts to build a sense being valued by and belonging to the wider course and university.

Reflective practice can support the combination of engagement and imagination by providing the opportunity to focus attention on personal development and career trajectory. The processes of identification through alignment can be built through actively connecting with the wider industry to build a sense of affinity through activities and speakers. Through the processes of identification students can begin to define the parts of the course that matter to them. From this point students can then seek to take responsibility to shape these elements and take responsibility to contribute and collaborate accordingly. The processes of negotiability through engagement involve the production and adoption of proposals. Developing the skill of opportunity spotting (Jones and Iredale, 2010; Kubberød and Pettersen, 2018) coupled with the ability to make effective proposals will be supportive in positive identify formation, whereas those who lack the confidence to put forward their ideas or are unable to learn from negative experiences are likely to see that their contributions are never adopted and will consequently become progressively marginalized with dire consequences for learning. Diverse opportunities for interaction and storytelling of shared experience contributes to the processes of negotiability through imagination which can be encouraged through the chance to personalise learning in response. The processes of negotiability through alignment takes this further through interactions with the wider community which benefit from active support from industry. Chapter seven builds on this summary by developing the four key pedagogic themes from the data as having contributed most to participants' learning.



Identities of participation	Identities of nonparticipation	Modes of belonging	Identities of participation	Identities of nonparticipation
Experience of positive teamwork Reflecting on the processes involved in effective teamwork Experiences of successful boundary crossing	Dwelling on mistakes and withdrawing as a consequence Negative experience at a boundary Inability to learn from negative experiences	**Engagement**	Having ideas adopted Growing ability of opportunity spotting	Having ideas rejected or lacking the confidence to put them forward Feelings of marginalisation Inability to learn from negative experiences
Feelings of affinity to the course or department Actively pursues personal interests Access to positive role models Engaging in wider university societies Emerging sense of career trajectory Resources for reflection	No access to positive role models Inhibited by self constructed stereotypes	**Imagination**	Opportunities to personalise learning Learning from vicarious experiences Engage in multiple activities to maximise interaction Confident in own ability to handle uncertainty and ambiguity	Passive or excluded from activities and interactions
Feelings of affinity to the wider industry Active membership of student committees or charities	Submission to feelings of powerlessness	**Alignment**	Supported by brokers to interact and challenge the industry Support for career self-management Active contributor to discussion boards and groups	Participation through a sense of obligation and compliance Little intrinsic motivation Limited or no sense of career trajectory

Figure 6.4 Social ecology of an emerging identity within fashion business (adapted from Wenger, 1998, page 190)

6.6 Chapter summary

It is argued that Wenger's (1998) learning architectures derived from his theory of the communities of practice is helpful to the design and facilitation of learning communities. The chapter has shown that the learning architecture concept makes a valuable contribution to design pedagogy in terms of helping to provide a more formalized approach to design. It is also as a tool of analysis and reflection pertaining to this intervention. The analysis

demonstrates how the three modes of belonging: engagement, imagination, alignment were supported in different ways within this intervention and this was seen as significant in developing productive learning community. The learning environment in the subsequent iterations has benefitted from the feedback from students to further develop mechanisms that encourage learner engagement including clarification on the mode in which to employ the different values of academic, industry or students' voices to encourage a network of interactive exchanges, the importance of live briefs and how PLM could be used to connect learning and activities in other modules. There is a clear resonance in the trajectory of the findings here and those of McIlveen et al. (2011) pertaining to the benefits of supporting a learning approach aligned with career development; the shared intention is to make higher education one of personal growth that prepares students for dynamic working environments. That is not to suggest that professional development can be achieved within one module, rather I argue in line with McIlveen et al. (2011) that there is potential in developing pedagogy within professional development learning that takes place whilst working within the industry.

In terms of engagement, although the time for a shared repertoire to develop was limited, the immersive brief does appear to provide a very intense experience which when coupled with the shared history of being on the same course (albeit perhaps in different years) seems sufficient in establishing trusting relationships and shared repertoire. The opportunity to open up previously closed cohort groups in a learning community appear to provide a powerful learning experience and the chapter has argued that it is important to make space in the timetable for these novel experiences. These experiences provide the opportunity to learn how to collaborate effectively as well as positively contributing to professional identity formation and a sense of confidence in emerging professional competence. Although external validation made a significant contribution it is important not to neglect the role of academic and theoretical knowledge in helping critical practice to develop further. Learning through engagement is developed further in two themes in chapter seven. The role of PLM as a context to engage in practice is discussed in section 7.2 and section 7.3 discusses the influence of role models within the same course.

Within the learning architecture model, the second mode of belonging, imagination is fundamentally about exploring different images of our future-self and the development of future-practice. The range of the learning activities and integration of multiple external stakeholders provided the participants with a diverse range of resources to support considerable imagination and reflection. Interaction with participants at different levels of experience sharing their experiences positively contributes to learning. However, within this

intervention, the process of reflection needed further examination in order to maximize benefits to all participants. How this intervention fostered mechanisms to bring in new experiences and contacts to incite the imagination for the development of practice is discussed in section 7.4.

The final infrastructure or mode of belonging is alignment, indicates the importance of linking the activities of a learning community of practice to the broader, external issues of the industry. Opportunities to test out ideas and to thereby encounter 'old-timers' can be difficult to arrange or have the confidence to do so. In section 7.5 more deliberately connecting with the wider community to provide opportunities for students to contribute their fresh perspectives is discussed.

Chapter 7 Key Pedagogic Findings

7.1 Introduction and chapter overview

Through the application of Wenger's (1998) learning architectures derived from his communities of practice theory, the previous chapters (five and six) have illustrated how the design of the intervention was fundamental in providing participants with varied opportunities for multiple modes of belonging. This chapter presents the key pedagogic findings that emerged from the data analysis of chapters five and six as having contributed most to participants' learning whilst acknowledging Wenger's warning that teaching cannot predict learning: 'practice is not the result of design but rather a response to it' (1998, p. 233).

There are four sections to this chapter:

Section 7.2 derives from the infrastructural component of engagement to expand on PLM as the context for engaging in practice. This section argues that PLM provided a context for a community of practice that enabled students to visualise how the curriculum connects with industry processes and practices. The approach of this intervention was to ensure that student activity is centred on 'learning through' exploration and experimentation within a PLM context rather than 'learning about' PLM more tangentially as another topic on the curriculum. Through participation within product category buying teams, the students engaged in building a proposed range within PLM. The connected nature of PLM helped to highlight the interconnectivity of the industry and to provide an overarching framework for students to connect all their learning experiences. Additionally, by engaging in the digitally sequenced processes in PLM, opportunities for insight and understanding of the complexity of practice are made and thereby facilitate a more critical approach to further research in the students.

Section 7.3 also derives from the infrastructural component of engagement to emphasise the significance of enabling the interaction with near peers through shared tasks to facilitate exposure to the vicarious experiences and visible career paths of other students termed 'paradigmatic trajectories' (Wenger, 1998, p. 238). This section recognises that near peer learning involving students from the same course, but at different levels has come into prominence in health professional education over recent years (McKenna and Williams, 2017) and highlights this aspect in supporting successful apprenticeship within the learning community. Near peers provide an invaluable range of visible trajectories to learn from vicariously and other opportunities and resources to develop self-efficacy.

Section 7.4 stems from the infrastructural component of imagination and acknowledges the role of PLM as a context for a community of practice as discussed in section 7.2 but identifies the limits of engagement. Although the shared activities in the buying team facilitate learning, the learning is limited by the specificity of the project task and the processes and practices of the current industry. There is a need to understand the place of these 'buying team' activities within the wider, complex and uncertain real world. This section illustrates how PLM provides a connection to the larger issues in the industry. The unfolding nature of PLM helps to provide a rich source of tools for imagining and proposing alternatives. Accordingly, coupling PLM with academic theory can contribute to the development of practice. Therefore, where section 7.2 sought to demonstrate how PLM opened up the black box of processes and practices such that they are understandable and transparent; this section builds on this knowledge to deliberately make these accepted routines of practice into objects of academic enquiry in order to produce novel and alternative approaches (Miettinen and Virkkunen, 2005).

Section 7.5 stems from the infrastructural component of alignment to build on the connection to developing practice from section 7.4 to consider how to more successfully utilise the energy and insightful perspectives of those at the periphery of practice. This section argues that newcomers are a source of energy and insight for change that has particular significance when the industry is in transition. Wenger proposes the notion of 'peripheral wisdom' (Wenger, 1998, p. 216) that summarizes the position being affirmed. It is argued here that the perspective of those at the periphery of practice needs to be harnessed more effectively in order to develop future practices. It proposes that PLM provides a bridge to open up access and facilitate a closer interface between the industry and its associated degree courses and calls for valuable, innovation spaces to be opened up. This recommendation to establish a more permeable interface between higher education and industry and a two-way flow of ideas is closely aligned with the ambitions of entrepreneurial learning and the findings of Kubberød and Pettersen (2018) and Rae (2017).

7.2 Engagement: PLM as a context for a learning community to engage in practice

This section illustrates how PLM supported learning in order to support the claim that PLM provides a robust methodology to drive innovation in the curriculum and pedagogy of fashion business. The basis of the argument is that as PLM has been widely employed in business transformation, it can be used to transform learning environments. The emphasis

of this educational intervention has been to leverage PLM to provide a focus and framework for the construction of such a learning environment which enables rich forms of learning participation within the community (Cousin and Deepwell, 2005, p. 63). Again, Wenger asserts against cause and effect thinking in the design by encouraging teaching to be seen as a resource for the learning community, positioning the role of pedagogy within communities of practice:

> *Once learning communities are truly functional and connected to the world in meaningful ways, teaching events can be designed around them as resources to their practices and as opportunities to open up their learning more broadly. Again, there is a profound difference between viewing educational design as the source or cause of learning and viewing it as a resource to a learning community (Wenger 1998, p. 271).*

It is important to appreciate the role that PLM plays within current practice. It is argued that PLM now represents the industry's current best practice and spans all the activities throughout the extended enterprise. Just as PLM evolved from PDM, inevitably new technologies will continue to emerge but currently PLM or more accurately PLM 2.0 or connected PLM is acting as a holistic term and hub (Terzi et al., 2010) PLM can be considered to be acting as a type of shorthand for convergence of different technologies and therefore represent the 'technology of practice' (Lave and Wenger, 1991, p. 101). PLM can support a detailed understanding of the practices involved on the journey towards full membership. Supporting this journey, technologies perform a mediating function connecting participation in current practice with the communities' history:

> *Participation involving technology is especially significant because the artefacts used within a cultural practice carry a substantial portion of that practice's heritage… Thus, understanding the technology of practice is more than learning to use tools: it is a way to connect with the history of the practice and to participate more directly in its cultural life (Lave and Wenger, 1991, p.101).*

The first role for PLM is as a map or framework of current processes and practices. Once the territory of practice is mapped the inner workings of practice, their sequence and the interconnectivity of processes and practices throughout the product lifecycle may become apparent. This insight of the inner workings of the 'black box' of practice is depicted in figure 7.1. This is about knowing more than 'what happens' but beginning to understand why it happens and what happens next though exploration within the PLM learning

environment. A more holistic, rather than a fragmented and functional, perspective of the industry, also facilitates students' identification of an area of interest to pursue in subsequent assignments, research and career planning. In this way it is possible to move beyond practices as taken for granted and seed a more critical approach to processes and practices.

> *The significance of artefacts in the full complexity of their relations with practice can be more or less transparent to students. Transparency in its simplest form may simply imply that the inner workings of an artefact are available for the learner's inspection: The black box can be opened, it can become a 'glass box.' …Thus, the term transparency when used here in connection with technology refers to the way in which using artefacts and understanding their significance interact to become one learning process (Lave and Wenger, 1991, p.101-2).*

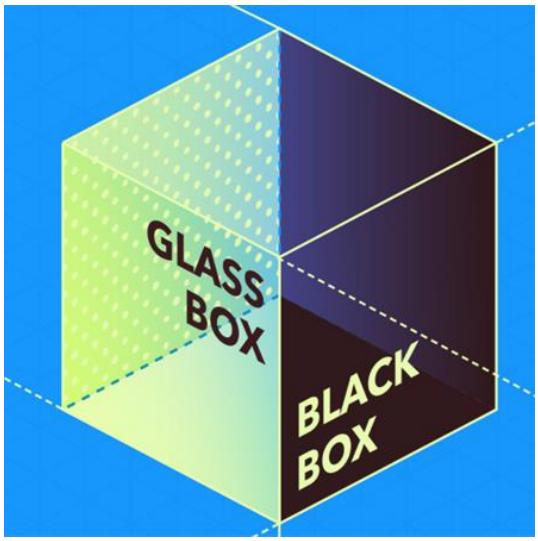


Figure 7.1 Illustration of transparency of process and practice: the black box opens, and becomes a 'glass box' (Trendwatching, 2017)

The significance of processes can remain opaque despite the opportunity for hands-on experience. Whilst the PLM teaching sessions has supported the learning of some students, providing 'a real insight into how it would work within a company' (question 5.3 taught session survey response). Other students explained that it was only through the opportunity of a live project did these begin to make sense: 'In the training, I couldn't really get the hang of it, but doing it in a project it all made sense' (PLM event week participant: video 36). This was supported by team members who stated that it 'helped [me] to understand what actually goes on in industry' and 'I had read through what a PLM system was, by

couldn't see how it would actually work. Now I see how it would work in real life with different people inputting into it across the business.' (PLM event week participant: video 36). These statements confirm that PLM is more fully understood through experiential learning rather than as an abstract business strategy. In this way, learning is secured through meaningful activity or 'learning through' exploration and experimentation rather than 'learning about'. However, this requires the students remain curious and open in order to learn:

> *I was so sceptical of the whole PLM thing towards the start - I don't want to learn this: it looks rubbish! And then I did it and I really, really enjoyed it! For me was learning about PLM because I didn't know anything about it and thought it had nothing to do with what I want to do… But now I understand why retailers would use it for management (Participant from final year 2015, Video 37).*

Whereas Caitlin was able to see that PLM will likely feature in the future workplace and recommends active exploration and experimentation in this safe environment before entering employment:

> *In the actual business environment, the likelihood is, that by the time they come to graduate, the company that you do go to work for is going to have PLM. So rather than waiting till you're in the business, where the job that you're doing on the system actually has impact - you could mess up a SKU [stock keeping unit or product line], that's the reality of it – why would you not want to trial that in in the University where it is not actually affecting real products? It's not actually affecting deadlines and stuff. It is a key industry tool that you are going to be using when you graduate and go into the industry, why wouldn't you want to trial it before you actually could potentially (laughing) mess something up on it? (interview with Caitlin, final year in 2015)*

In contrast to this spirited openness, an alternative perspective of technology in the workplace is one where technology is seemingly ever-changing which can cause a more cautious or strategic approach to learning. This uncertainty was highlighted by a second-year student who raised concerns in the first training session - 'are we not using WGSN [a trend platform] anymore?' and adding 'Is this what I will be using next year? As I've only just got used to [Adobe] InDesign.' Clearly the plethora of retail technology can be confusing, highlighting the need to carefully describe the ongoing digitalisation of the sector

and the associated convergence and interoperability of software as a continuous upgrading or evolution rather than as redundancy and obsolescence. Within this evolution, PLM has a strategic and central role in avoiding piecemeal digitalisation (Terzi et al., 2010).

As outlined in chapter five, the intervention was designed to provide the students with an overview of the role of PLM within the industry from an experience of participation. PLM provides an environment where students can mimic the processes and practices through engaging in a mutual task. The immersive brief of PLM event week provided an opportunity to participate as part of a buying team to propose a range through inter-year working. It is important to reiterate that the PLM event week was optional but was a significant learning experience for those who attended. There is a concern that some students may have felt less able to participate through lower levels of confidence, experience or time available and are therefore at risk of feeling marginalised. However, it was not possible to build this event into the timetable due to availability of rooms for keynote speakers, team activities and the final presentation.

Although it is difficult to portray a sense of community or mutual engagement on a shared task the images figure 7.2 are a representation of this shared experience which was also captured in articles published in the online magazine WhichPLM by the students (appendix 11 and 18 and figure 7.3). Further, the survey data reported that students considered that the team worked well together (mean 5.58 / 6), achieved an effective presentation (mean 5.52/ 6) and enjoyed meeting and working with new people (mean 5.75 / 6).

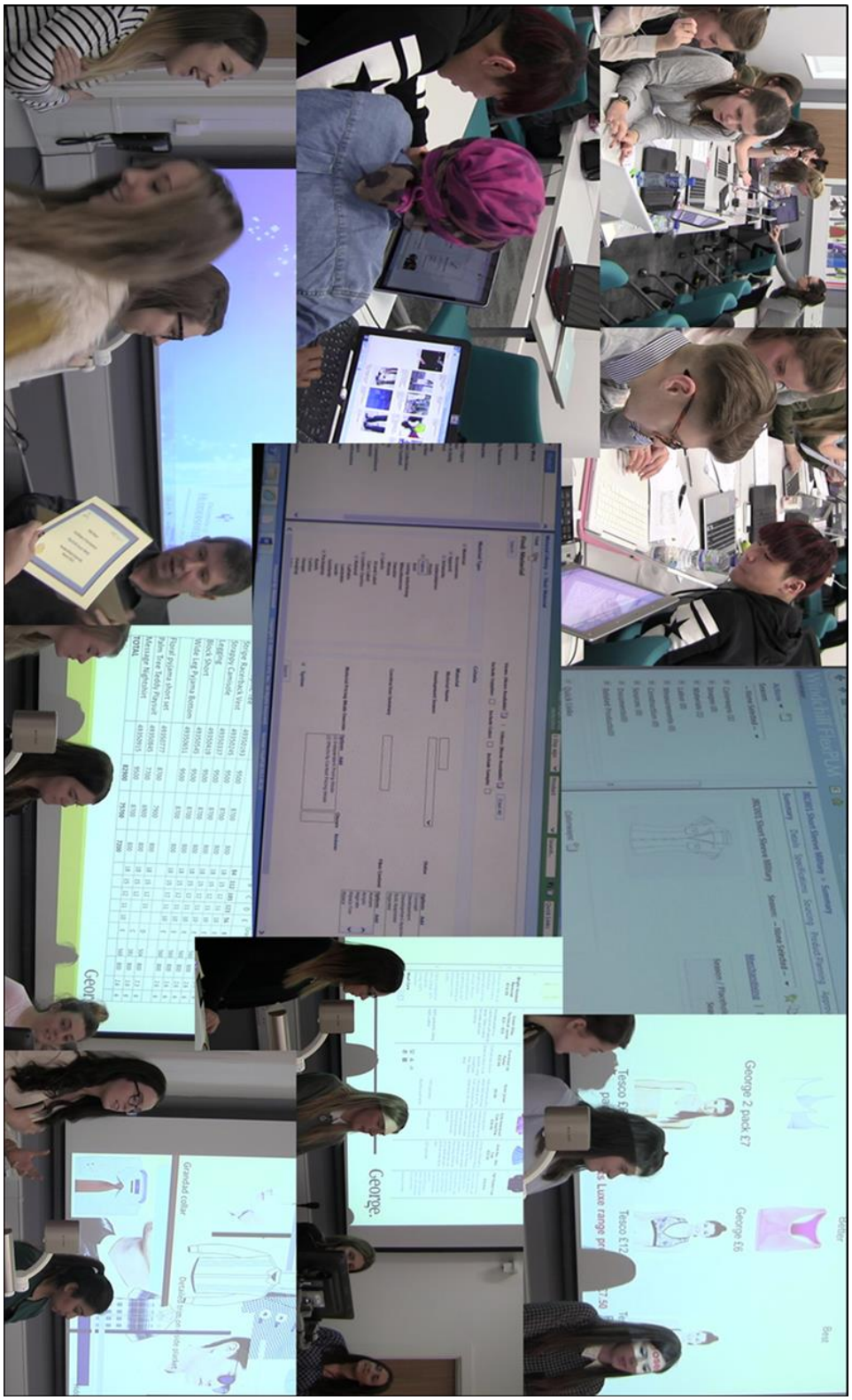


Figure 7.2 Images of the shared activities working with PLM

Two student remarks summarize the experience of working with others: 'everyone has things and that they are different, everyone in the team has different strengths and that worked well. It was good to be able to establish people strengths and then use them' (final year student, video 36), and of the role of PLM in supporting collaboration:

> *By taking part in this project, it is easy to see the vast benefits that PLM has to offer us, as future industry professionals. It has become clear that PLM software can help range planning, and the compiling of a tech-pack can be much more efficient and collaborative. The collaborative benefits are boundless, as information is much more easily shared – once the data has been inputted, anyone able to access that data can see updated information in real time which, in theory, should help quicken and streamline the communication cycle between key players across the buying chain (second year student).*

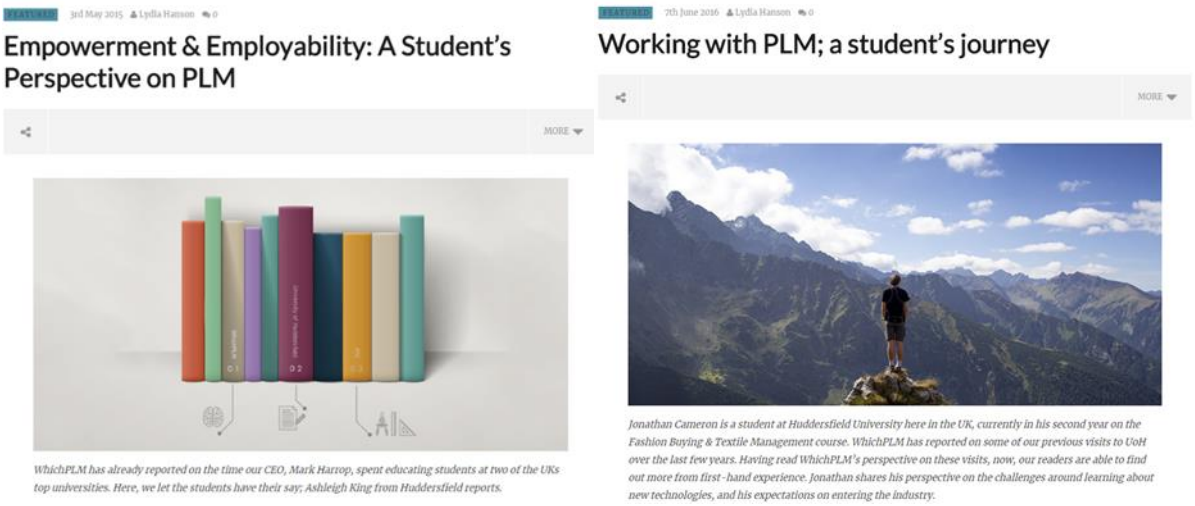


Figure 7.3 Student articles for WhichPLM digital magazine (appendices 17 and 18)

However, this notion of working as a contributing member in a collaborative community – regardless of whether one that is enabled by technology like PLM or just operating with standard spreadsheets and emails – is difficult to grasp without work experience. The students commented on the significance of the live brief in making the task more authentic or closer to 'real-life'. The students commented that it 'felt like a real-life brief', 'great, realistic task – which is achievable' was 'very realistic and applicable to industry' and "it was very realistic and so more engaging' and 'made the event more useful' that they 'enjoy the mix of working on a range and with PLM' with 'guest visitors help bring the project to life'

and finally 'the fact that Nicola from George came along made it feel as though we were really working with the company.'

The students were given the opportunity to 'perform like' industry professionals with a final presentation of their proposed range to the industry and academic panel. Although the PLM event week was not designed as a competition, the members of the team that was considered to have given the most professional presentation were offered work experience at George's head office. Following each presentation, the students received positive feedback and additional comments that confirmed that they had demonstrated competence as illustrated by these two comments from the panel member from the retailer George:

> *I really like the level of detail you've gone into on your competitor analysis. I love the fact you mentioned: good-better-best which is something that we would benchmark against. I like the fact you thought to look to our website to find approved factories. I like the fact that you indicated that you have considered more than you have put forward for selection. That is something that we always do - this gives some flexibility to mixing and matching. I also like the fact that you had considered different size ratios for different products although this would always be open to challenge. It's good that you had considered what she would wear, although these are difficult conversations and decisions. (Tarratt, PLM event week presentations)*

> *…previously my background was senior merchandise manager for George, so I would have signed off that money on the garments that you've presented here, I'd have spent that cash with some extra information on the costing - I don't expect you to have done that level of detail here - I would have signed off on that and I think your comp shop work is easily comparable to what we would see back in the office, so thank you for that. (Tarratt, PLM event week presentations)*

Following the presentations all panel members were encouraged to give feedback and ask questions, facilitating further conversations and negotiations relating to future practice that Wenger terms 'generational encounters' (Wenger, 1998, p. 99). Firstly, to show support for the effort that had been necessary to master the technology and make a success of the project task:

> *'You have to go through the pain of using the system, how you add images, how you connect this with that and so on but eventually it is like driving a car - you don't think about holding the steering wheel, or what you are doing with the accelerator and so on, you don't think, and PLM becomes you don't think. It does become something in the background, in the very beginning, oh it is really hard! [Laughter] …there is no gain without pain… You will get there. Congratulations!' (Harrop, PLM event week presentations)*

These generational encounters revealed industry insights and alternative perspectives regarding continuity or discontinuity of practice. Although many of these comments reiterate concepts raised in the wider course, they appear to resonate more powerfully with the students when from an external source, as was also noted by Orr and Shreeve, (2018, p. 151) and this seemingly influenced the topic choice of the students' case studies. For example, Harrop highlighted how millennials have a greater concern for product provenance: '…your generation care about supply chain... What we are going to see is when you use the materials library you will see a score, you will have the ability to compare [fabrics and sources], to understand your impact and make changes.' (Harrop, PLM event week presentations). Equally how advances in data analysis would improve forecasting: 'One thing you did very well was competitor analysis. There is [now] technology to allow manufacturers to do that – to listen to all the noise, the positive and negative, to drive design; unless you are at the luxury end of the market where you create trend then you will be steered by the rest of the market.' (Harrop, PLM event week presentations). Equally, the students were critical of the user interface and made sound recommendations for the ongoing development of the software (video 38). Although some of these were due to the initial set-up of the system, they clearly highlighted how important the interface was for successful adoption. The students also made recommendations to bring the ideation stage into the system more directly; this creative collaborative mood boards app was released by PTC in 2018, showing the students thinking was in line with industry developments. As a consequence, another live brief was initiated to give the students the opportunity to test the mood board app shortly after launch. Details of this event are provided in appendix 19.

Figure 7.4 NVivo Word Cloud of event survey 'three words' to summarize the experience of participating in PLM event week

This section presented the data to illustrate how PLM supported the development of a community of learning such that during PLM event week, to simulate the environment and experience of 'real-life' buying teams through coupling PLM software with a live brief. Figure 7.4 has been compiled from the event survey requesting 'three words' that summarized their experience during the week's activity which supports the claim that the activity was informative, positive and engaging. The incidence of 'stressful' would seem to relate to the 'tight time-frame' reflecting the demanding and hectic pace synonymous with the nature of the industry and the authenticity of the project task. This is an example of an immersive live brief that offer an intense learning experience where there was a benefit for both industry and the students (Orr and Shreeve, 2018, pp. 110-111), summarised by a course team member:

> *PLM has the advantage that the students are not learning in isolation to fulfil an assessment brief - it makes the task seem real. As it is an internationally recognised tool it will help differentiate the student's employability internationally and not just in the UK (Course team member).*

7.3 Engagement: PLM facilitating the interaction with near peers through shared tasks

Design pedagogy and the theory community of practice share a conception of learning as a trajectory towards 'becoming' a full member through the process of increasing participation in the practices of a community (Shreeve et al., 2010, Tovey, 2010, p. 30). As students develop professionally, they engage in identity work through the suggestion of possibilities and opportunities from exposure to the activities in the community: 'a community of practice is a field of possible trajectories and thus the proposal of an identity' (Wenger, 1998, p. 156). Accordingly, participation in the community of practice offers a sense of possibility to learn and shape a professional identity through integration of new knowledge and experiences that are encountered and therefore having access to a wide range of influences maximises the spectrum of possibilities. However, a means of navigating these influences at the personal level is needed. Wenger (1998) describes the importance of the 'paradigmatic trajectories' as a set of models or negotiating trajectories provided by a community that shape how individuals negotiate and find meaning in their own experiences. Wenger proposes:

> *Exposure to this field of paradigmatic trajectories is likely to be the most influential factor shaping the learning of newcomers. In the end, it is members – by their very participation – who create a set of possibilities to which newcomers are exposed as they negotiate their own trajectories… paradigmatic trajectories provide live material for negotiating and renegotiating identities (Wenger, 1998, p. 156).*

Wenger is careful to insist on a definition for these 'paradigmatic trajectories' as a general notion involving a community of mutual relations of engagement that is less specific than a role model but more specific than the social theorist Mead's notion of the 'generalised other' (1934, cited in Wenger, 1998, p. 294). However, this is perhaps to interpret the notion of role model too specifically, whereas it may be conceived more broadly viewed as a composite constructed from many people's experiences or as a drawing out of positive attributes (Singh, Vinnicombe and James, 2006, p. 69). Many studies have portrayed the importance of the role model construct in supporting the transition from education to work: Gibson (2003, 2004) makes a strong case for reinvigorating the role model construct given its influence on a variety of career-related outcomes; Hill and Vaughan (2013, p. 548) concluded that role models are important for students seeking access to learning opportunities when considering diverse future careers echoing Quimby and DeSantis (2006, p. 304) claims that identification with role models is critical in the career decision-making

process. This was discussed specifically in 2017 during the recall activity. The interactions were remembered positively:

> *I had [names a final year student] in my group and she'd been on placement and done PLM and was really passionate about it. That was really good, she was proper encouraging. I also remember working with [names a final year student], she already had her idea for final major project in February. She was telling me about the magic mirror idea that she had seen on placement. I remember things like that. That was quite inspiring, they were also welcoming and fun. (Liam, second year in 2015)*

The difference was remarked on again:

> *I can remember exactly the two final years that we worked with but it was good to see all the final years, just to see them present. I've never been scared of doing presentations, but the final years presented really well…You could see how the difference between final year and second year - they knew what they were doing. There was one girl who went on to get a job at George…she really knew her stuff! (Karen, second year in 2015)*

That is not so say that the students were uncomfortable with this difference in experience or intimidated by it, but were aware it affected their behaviour:

> *I think looking at myself, the thing I'd like to say, is that I feel quite different from how I was before placement and that was obvious in them as well. They seemed to be really clever. Not old but it seemed that they knew what they were talking about. I remember being really quiet and not saying much… Yes, I remember being quite quiet, I think. I remember just thinking I'm just the younger one, that my opinion, not that it doesn't matter, but perhaps isn't as valid. (Karen, second year in 2015)*

The power of the immersive brief experience is perhaps best summarized by Jemma, illustrating how she maintained contact for further support, was influenced to try out a new career direction on placement, could see her own trajectory open up and was motivated by this interaction:

> *I think it [event week] was my most memorable experience. One, working with the final years was a really good opportunity. I think my main memory that [names a final year team member] was really good and on*

the merchandising side... We had done the business school but it's not the same. So, seeing that side of things and then going on placement and coming back and it seemed so simple! It makes you aware of it. I learnt a lot from seeing what they could do, compared to what we could do. I have gone back in the past spoken to them - it's been useful to have that kind of contact…it kind of puts in your head, cementing it in your head, that you will get to that stage. That didn't just happen, that didn't come out of thin air. They got there from doing the whole course…It made me feel like she's not just come on the course and known everything, she's actually learnt that. ***It gives you the initiative to push, you can be at that stage****. It pushes you to carry on… I didn't want to go anywhere near merchandising for a placement but after speaking with [indicates final year team-member] I thought it would help, even if I'm not very good at it, to have that background knowledge to help me in my [buying] career.' (Jemma, recall event)*

Given vocational courses can be seen to represent a threshold to the professional community, it is argued that the notion of role models offers a potentially rich resource to enrich the educational experience of students in further ways beyond those directly related to careers. It has been reported that this sense of community is likely to benefit students' studies, assisting them to develop a sense of belonging within their chosen profession and strengthening self-efficacy (Bellò, Mattana and Loi, 2018). Learning environments employing design pedagogy mimic legitimate peripheral participation and seek a broad range of influences such as visits, exhibitions, guest lectures, conferences. These experiences frequently entail an interaction or encounter with 'old-timers' (Wenger, 1998, p. 156). However, 'near peers' or students from the same course but at different levels are a more readily available and largely untapped resource. There is a sense of reassurance and commonality from the shared experience of having been to the same university or social proximity that closes the gap in experience. The concept of a 'near-peer' was defined by Ten Cate and Durning (2007 cited by McKenna and Williams, 2017, p. 77) as when '…the teacher and learner are on the same educational level but separated by one or more years' and has gained prominence in health professional education over recent years. The 'near-peer' is perceived by students to have a level of expertise, that lecturers do not, to provide information on a range of issues relevant to students. This highlights the crucial role of near-peers in supporting successful apprenticeship that could be readily and frequently coordinated. This exposure to a range of influences can be encouraged through activities

such as presentation of placement reports, induction events, alumni masterclasses, social events and field trips. Students quickly draw information from multiple sources in order to make sense of new specialties they encounter (Hill and Vaughn, 2013, p. 554). The concept of paradigmatic trajectories is useful to explain the processes through which students use what they can see, the stories of others, and their experience of participation to imagine a future career.

7.4 Imagination: to stimulate practice development

The previous sections, 7.2 and 7.3, highlighted two elements built on the infrastructural component of engagement that students had reported as significant in their learning experience. Section 7. 2 illustrated how PLM was used as a mechanism to framing the curriculum as a body of knowledge that can be applied in practice and provide opportunities for the students to experience working collaboratively as a novice in the learning community. In this way, as discussed in section 5.2.2, PLM is used as a conceptual framework and educational context that represents 'as is' to orient students in the history, processes and practices of the industry and to make them transparent. However, without actively designing in opportunities for imagination and alignment this environment could ossify to simply mimicking existing processes and practices and therefore be reduced to technical training with no opportunity to develop practice. Therefore, although PLM can support the creation an engaging learning environment, without the other two elements of imagination and alignment it is potentially limited. Engagement can clearly have a powerful impact on identity formation, but this has limitations as cautioned by Wenger:

> *…through engagement, participants do not necessarily understand the world, each other's experience, or their shared enterprise more accurately. Mutual engagement merely creates a shared reality in which to act and construct an identity. Imagination is another process of creating such a reality (Wenger, 1998, p. 177).*

Further, as outlined in section 6.3.3, imagination allows for this shared experience to become expansive in terms of identity formation. The broad-spectrum of fashion organisations represent a wide-ranging field of imaginable future careers. Through exposure to a range of these opportunities, undergraduates can begin to direct their trajectory into the industry.

This intervention recognised that communities of practice are not necessarily progressive and deliberately fostered mechanisms to bring in new experiences and contacts to enrich the learning environment are able to support the infrastructural component of imagination:

> *The possibility of engagement is critical to learning, but it can be narrow. Although communities of practice are places of learning, the learning they enable does not necessarily include expansive images of history, possibilities, or of complex systems writ large. It takes imagination in order for learning to encompass and deal with the broader context (Wenger, 1998, p. 238).*

Although opening up the community of learning to external parties clearly enriched the learning context, focus is still on existing practice or 'as-is'. The intention was to actively encourage students to view practice as inherently reproductive and to start to ask questions rather than accept this status quo. As introduced in chapter two, Wheelahan (2010) argues for the need to embed academic theory in vocational courses in order for them to develop beyond the contextual in order to access abstract theoretical knowledge as the means to imagine alternative futures. The argument of Orr and Shreeve (2018, p. 152) aligns well with this sentiment: to strive to balance the appealing authority of industry voices with the sense that academic theoretical knowledge has a contribution to make to ongoing practice development.

The second assessment, the individual PLM extension case study seeks to bring in these elements of imagination, to encourage students to network to research a contextualised problem and review through the lens of academic theory. The aim is that through exploration and reflection, students can find an area of practice in which they wish to contribute and to be equipped with a mind-set to contribute positively. The purpose of the case study is to build on initial engagement with industry practice and seek to question, challenge and explore a topic by identifying a suitable case study question and organisation on which to report. This task requires students to produce a synopsis of a real-life business scenario and propose a solution for it. In making a business case for this initiative, the case study shows the application of business theory. This is similar to the type of task a graduate might be asked to perform as a 'stretch project' (Valerio, 2009, p. 37) and the completed report can be considered to be another boundary object in that it is recognised both within education and in industry and demonstrates the students' competence for a new era in business. The open characteristic of PLM highlights that practice is not stable and is in a state of evolution. This instability can be utilized to make these routine practices objects of

enquiry (Miettinen and Virkkunen, 2005, p. 438) and articulate these as case study questions to research the development of practice.

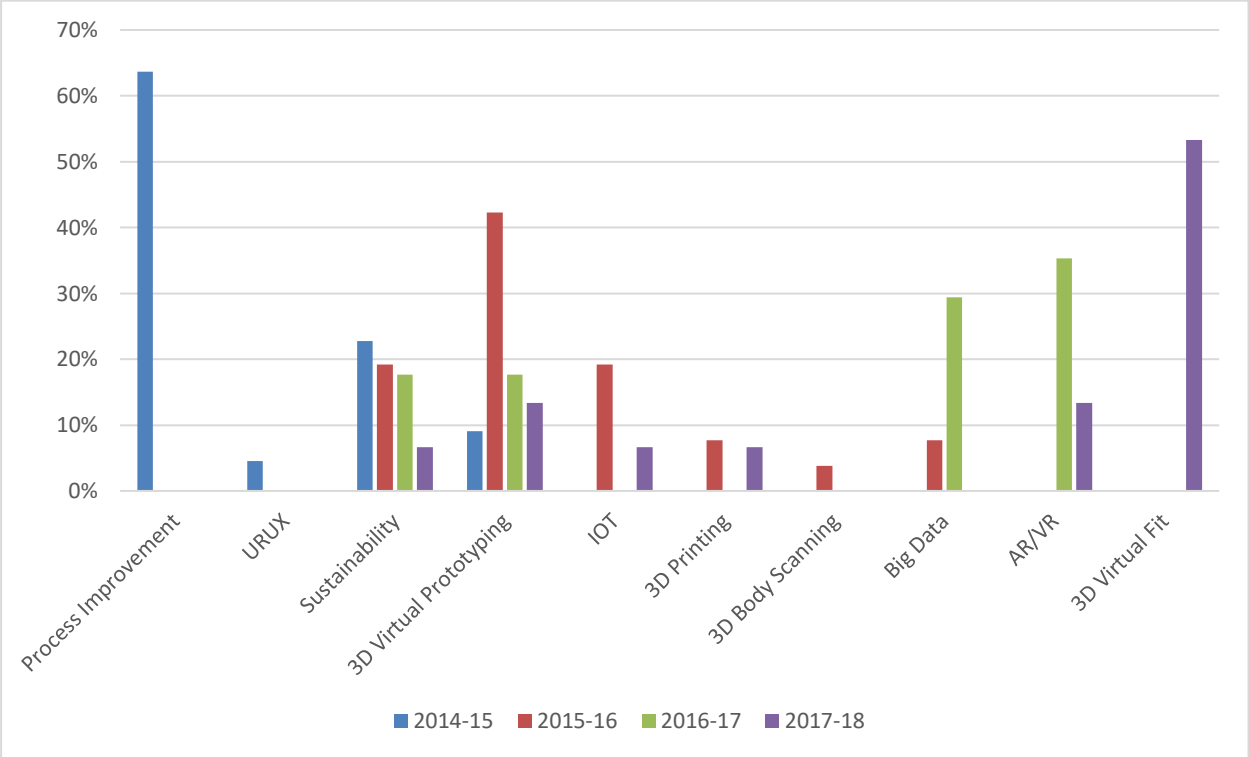


Figure 7.5 Case study topics 2014/15 to 2017/18

The case study topics that the students identified in the academic years 2014/15 to 2017/18, as illustrated in figure 7.5, are: 3-D body scanning, 3-D printing, 3-D virtual fit, 3-D virtual prototyping, augmented reality/virtual reality (AR/VR), big data, Internet of things (IoT), process improvement, sustainability and user interface/user experience (UI/UX). Although there is diversity in the topics, it is interesting to note how the taught content influenced the case studies. In the first year, 2014-15, the emphasis in the taught sessions contained a significant part on operational management and business process improvement (BPI) seen in the number of corresponding case studies in this area (figure 7.5). Whereas, in 2015-16 the taught sessions emphasised future industry trends and PLM 2.0 that is reflected in the case topics of 3D virtual prototyping, sustainability and IoT. A PhD student presented his AR / VR research in 2016-17, which clearly inspired case studies in this area. The emphasis in 2017-18 was on the persistent industry challenge of fit. So, although some topics always have some interest, for example sustainability and virtual prototyping, the impact of the supporting sessions and guest speakers clearly has an impact, demonstrating the potential to stimulate interest in specific topics and potentially leverage these encounters to inspire innovation and positive change in existing practice. This learning

experience encourages exploration through which students can identify an area of practice with which they can begin to locate themselves. This section has illustrated how the learning community was enriched by external interactions in order to support both the development of practice and emerging professional identities. The case study complements the activities within the PLM system by encouraging students to challenge the tendency of practice to be reproductive by actively researching alternatives. Doing so necessitated a further interaction or 'generational encounter' (Wenger, 1998, p. 99) with the wider community. It is precisely this interaction of old-timers and newcomers that is the focus of the next section in this chapter.

The inclusion of primary research is a requirement of the case study. This is not an easy task for an undergraduate to achieve but is deliberate effort to open up the learning community and encourage an interaction with the industry. As highlighted by Orr and Shreeve (2018, p. 151), the University is not seeking to precisely replicate practice but comprise a safe place for learning through experimentation. Consequently, it is important to demonstrate how the students' research was supported and facilitated. We have utilised the professional social media platform LinkedIn and established a fashion and textiles group within this where students, alumni and guest speakers are encouraged to interact. This group was established to provide a mechanism to hear industry news and begin to contribute to these conversations and more about this aligned project can be found in a short article appendix 20 (Conlon, 2017). The LinkedIn group enabled a means to establish a permeable boundary around the learning community that has been advocated by others (Cousin and Deepwell, 2005; Rae, 2017) and aligns with Wenger's warning against educators' attempts to try to be 'the entire learning event' (Wenger, 1998 p. 275):

> *…it cannot be closed system that shelters are well engineered but self-contained learning process. On the contrary it must aim to offer dense connections to communities outside setting… Learning communities cannot be isolated. They must use the world around them as learning resources and be a learning resource for the world... When old-timers and newcomers are engaged in separate practices, they lose the benefit of their interaction (Wenger, 1998, p. 275).*

7.5 Alignment: harnessing peripheral wisdom

As discussed previously, the notion of communities of practice closely associates with the principles of design pedagogy though the efforts to offer diverse sources of opportunities for

undergraduates to access a diversity of practice and thereby support connection with the broader fashion industry. Accordingly, sections 7.2 and 7.3 highlighted the important role of engagement within the community of learning for the development of a sense of awareness of practice, developing interests and confidence regarding a competent professional identity and then section 7.4 emphasised the important role of imagination to encourage a questioning of existing practice through individual academic research. This section builds on this emerging interest and takes its focus on the final infrastructural component: the role of alignment to highlight the need for experiences within the community of learning that bring into focus an area within the industry with which to align themselves, as it is '[T]hrough alignment, we can learn to have effects and contribute to tasks that are defined beyond our engagement' (Wenger, 1998, p. 239). Thus alignment, the sense of being part of something bigger than ourselves, is an important aspect of belonging. Aligning our efforts through legitimate peripheral participation in the discourses of selected brands, organisations or movements within the industry can provide a rich source of identity and this 'makes us 'larger' by placing our actions in a larger context.' (Wenger, 1998, p. 195). Alignment, however, might also appear to suggest continuity and conformance with existing practice rather than encourage discontinuity and change. The challenge for the newcomer is to learn how to couple their critical awareness with theory in extending or moving the discipline forward (Orr and Shreeve, 2018, p. 151) as they navigate their trajectory to full membership. Change is essential for the development of practice and the future of practice is of particular significance to newcomers and this encourages them to achieve this balance:

> *[O]n the one hand, they need to engage an existing practice, which developed over time: to understand it, to participate in it, and to become full members of the community which it exists. On the other hand, they have a stake in its development as they begin to establish their own identity in its future (Lave and Wenger, 1991, p. 115).*

There is therefore an opportunity for organisations to benefit from this motivation to drive practice forward, but this requires a deliberate approach in the interactions and socialization of newcomers. The provision of access alone does not secure the potential that legitimate peripheral participation offers. It requires more than securing entry points and the possibility of experience of practice and exposure to practioners to be truly effective. There needs to be a receptiveness in the members of the community to recognise the possibility to gain something of value from this alternative perspective. In this way there is reciprocity or an exchange of ideas and that both sides act to facilitate two-way traffic of ideas.

> *Legitimate peripherality is important for developing 'constructive naive' perspectives or questions. From this point of view, inexperience is an asset to be exploited. It is of use, however, only in the context of participation, when supported by experienced practitioners who both understand its limitation and value its role. Legitimacy of participation is crucial both to this naive involvement to invite reflection on ongoing activity and for the newcomer's occasional contribution to be taken into account. Insofar as this continual interaction of new perspectives are sanctioned, everyone's participation is legitimately peripheral in some respect. In other words, everyone can some degree be considered a 'newcomer' to the future of the changing community (Lave and Wenger, 1991, p.117).*

Establishing a better flow of ideas would support efforts to harness alternative perspectives from the periphery of practice. Wenger proposes the notion of 'the wisdom of the peripherality – a view of the community that can be lost to full participants' (Wenger, 1998, p. 216) that summarizes this position being affirmed: that newcomers are a rich source of energy and insight for change within an industry in transition. It is argued here that the perspective of those at the periphery of practice needs to be harnessed more effectively in order to push practice forward:

> *This segregation, which is typical of the modern experience of youth, is doubly costly. The young are not given a chance to invest their fresh energy in pushing histories of practice forward, nor is their unbridled naiveté subject to the encounter ability inherent in engagement in actual practice (Wenger, 1998, p. 275).*

Given the low level of PLM knowledge in the sector (Easters, 2012; Saaskvuori, 2011), there is a real opportunity for these students to differentiate themselves and contribute in this area. The industry has a conservative approach to the adoption of technology whereas from the consumer perspective, technology is rapidly extending and unfolding in a myriad of ways. During their undergraduate studies, students experience a progressive curriculum and this presents an opportunity for organisations to learn vicariously. This section demonstrates the potential for PLM to act as a bridge to facilitate a two-way flow of ideas between industry and higher education to contribute to the development of practice. The students were clearly aware of their potential to contribute:

> *The first thing I remember about PLM on placement was when [names manager] had been to a meeting because they were thinking of*

implementing a system …and he came back with a massive thick booklet and I asked him what it was…That's my first memory on placement of PLM being relevant and him not knowing anything about it, just going to a meeting because it was called on to do it…then (again) towards the back end when they did the big conference with the roles coming up in the business change team. I am surprised, well not surprised that we didn't get in, or time offered time in there, I suppose they didn't know that we had worked on this and ***our knowledge would be better than everyone else's*** *in the room. I think we could have just helped out on it. (Liam, recall activity interview)*

I know that (for) the older buyers and merchandisers, it wasn't around when they were at university, I think that perhaps they might not value it is as much. I know that's not what I should say but that's how I feel that ***I will be bypassed and not taken seriously****…Even when I did mention it [PLM] in my interview, I think it was in the part about future opportunities for the business, the Merch just looked blank, and didn't seem to follow the conversation at all…****the knowledge doesn't seem to be there*** *(Nadine, final year interview).*

Although the digital transformation of the industry is widely reported, reported as a seismic shift this does not seem to be a priority within the buying teams of large retail organizations. Without a deliberate policy to capture the vicarious experience and insight of newcomers, the views of inexperienced staff are easily overlooked. Students were aware that the lack of digital knowledge within experienced staff presented a barrier for their contribution, they are able to understand how it occurs:

…when you're in a business you should know what's going on. You shouldn't just be on top of the latest fashions, but you should also be aware of how you can get your business to be the best of its ability. How you can be more streamlined. It shouldn't just be about the latest trends. But then, I know how busy it is. When they go home, they don't want to be looking into the different things that are going on. (Gayle, final year in 2015)

This was reiterated in the recall activity. During their placement these students had experienced a business undertake a significant change project and were very aware of how this change felt within this organization and can reflect on this significance themselves:

Student1: I think that they are perhaps too wrapped up in their day jobs…I think people are very much wrapped up in the right now and maybe that's why

Student 2: …probably lifestyles really…people get older and have kids they don't go on the Internet and read stuff. They don't read Retail Week and things like that perhaps…

Student1: …probably when we were doing those courses, we didn't realise how big a deal it was… people don't realise just how much it's going to impact them and how much they should know. They just don't. It's not getting told, they just think what this is my day job and just get on with the day job

Student 2: …supposedly working 9-to-5 in an office you don't want to go home and research PLM! ...Until it has to change. Until the whole thing changes.

Student 1:

They just get into a habit of doing things, and you're like- no, you need to shake this up!

(Karen and Liam, recall activity)

Communities are thus deprived of the contributions of potentially the most dynamic, albeit inexperienced, segment of their membership – also the segment that has the greatest stake in their future.

The students also recognised that investment decisions are at risk without considering contemporary fashion knowledge:

It (the evaluation and proposed investment decision) came from a small IT team, some from finance and then the board of the directors. The directors aren't even involved with using any of the systems that we currently use. The people making the decision made it based on money – the people who are investing do not realise the benefits. The director of Merch hasn't worked on the office floor for over 10 years. ***All the systems that she***

> ***can remember are 10 years old and are therefore are out of date and therefore anything [newer] would look great. So, then companies make wrong decisions.*** *(Gayle, final year in 2015)*

But there is still an enthusiasm, excitement and energy to make a contribution. It is through the sense of alignment that our power and sense of the possible are amplified (Wenger, 1998, p. 180):

> *So, having that from an educational background as well, actually having dealt with in a classroom, is really good. I feel that companies aren't going to know what's hit them when us graduates come and join. We know all this stuff; I think it's really good. I think this is where the change probably has to come from. Some people, like when I was at [company name] literally no one had even heard of it. Some people had been working there for 30 years or something, businesses like that who are doing good business,* ***they are so ingrained in their old ways of working, it's like 'if it's not broken don't fix it' so it needs to come from somewhere****. The fact that we are being educated to know this is really great.…especially because of all these high-calibre implementations that are happening more recently,* ***I think it will filter through.*** *(Caitlin, final year in 2015)*

There is clearly an opportunity to create shared value from the insight and learning experiences around PLM that would offer a benefit to the industry. Achieving this requires strong central – peripheral connection. It is argued that to support such innovations and creativity in organisations, the boundary between higher education and industry needs to be much more permeable. Some organisations are moving towards adopting formal mechanisms to maximise the benefits of peripheral perspectives (Rae, 2017, p. 487) which support developing an organisational culture to support newcomers to voice their opinions and to facilitate genuine two-way flow. For example, Gucci has a 'shadow committee' of advisors under 30 (Bain, 2017) to feedback to executives and create change. An extension of this type of effort is now being developed around PLM through the partnership and other external stakeholders. Similarly, Wenger argues for openness, for the combination of engagement, imagination and alignment and against educators attempting to substitute for the world by warning that:

> *…it cannot be a closed system that shelters a well-engineered but self-contained learning process. On the contrary it must aim to offer dense connections to communities outside setting… learning communities cannot*

be isolated. They must use the world around them as learning resources and be a learning resource for the world. (Wenger, 1998 p. 275)

7.6 Chapter summary

This chapter has reported the four key pedagogic findings of this intervention. Students have learnt industry processes and practices through a process of collaborative exploration with PLM as a framework to guide their journey and providing a focus to the community of learning. This journey has been enriched by the vicarious experiences of near peers. The students have been encouraged to consider innovative solutions and product offerings through the use of PLM to suggest 'next practice'.

At the heart of the design of this intervention was an educational partnership for PLM and an emphasis on direct engagement with the technology that is enabling the digital transformation within fashion retail. This provided a focus in the intervention to construct a learning architecture to enable student participation. The notion of a community of practice is important in encouraging the participation of students in an environment that offers a wide variety of interactions. These interactions open up possible trajectories that support the journey of students to full members in the industry.

This intervention has facilitated an understanding in the students of PLM beyond its capacity as an enterprise software to one pivotal in a strategic approach to change. More importantly, the external stakeholders have facilitated access to the industry through their participation and support of learning events, student research and early career explorations. Such support is crucial in opening up learning spaces beyond the boundaries of formal education and support the successful transition of students into the workplace: 'to become a full member of the community practice requires access to a wide range of ongoing activity, old-timers, and other members of the community: and information, resources, and opportunities for participation.' (Lave and Wenger, 1991, p. 100).

Chapter 8 Conclusion

8.1 Chapter summary

The aims of this study were described in section 1.4 and are reiterated here for clarity. The first aim was to employ PLM to establish a community of learning between students, educators and industry with the intention of creating a participatory learning experience that mimics current practice rather than adding digital transformation to the curriculum. This chapter argues that PLM provides an effective vehicle for change in the curriculum and pedagogy of fashion business as evidenced by this thesis. At the heart of this educational intervention was an understanding of PLM beyond its capacity as an enterprise software but as a strategic approach to change. The intervention was initiated by considering PLM's role in business transformation in a time of rapid change and subsequently considered how might it be employed to support change in an educational context given the centrality of PLM in the associated industry. This is not to argue for the specific use of PLM technology per se, but to use it to illustrate how it can provide a more forward-facing educational experience for fashion business students. The notion of community of practice was important in supporting the vision for this intervention; the communities of practice theory has been used in conjunction with PLM as a conceptual framework and context to create an updated learning space. This learning space was designed to offer a wide variety of interactions that made practice transparent, shared experience, introduced interests and thereby suggested possible trajectories to pursue as they make the various transitions through higher education, into the workplace and on to full membership in the industry. Consequently, this thesis adds to the emerging revitalisation of the relevance of Wenger's (1998) communities of practice theory within higher education.

Within the fashion industry, a seismic transformation (Crewe, 2012) is in process with the digitalisation of the industry, the ongoing congruence in job roles away from specific function to inter-professional activity (Guile, 2010, p. 59). In common with all vocational learning, educators within fashion business courses are challenged to consider the content and relevance of their modules and courses as the industry evolves. Reflective practice is at the core of the conscientious educator's ongoing practice (Clegg, 2000) requiring us to consider our teaching practice in a wider context or risk it becoming localised and ossifying into a 'pedagogy of inertia' (Shulman, 2005). These deliberations involve a complex reflection of how to transform knowledge (conceptual and contextual) into a curriculum that can then be designed for learning. Ashwin (2014, p. 124) argues 'these transformations are

the sites of struggle in which different voices seek to impose particular versions of legitimate knowledge, curriculum and student understanding'. The second aim of this study emerged from reflective practice: to design a learning environment that uses the PLM system to update, sequence and connect the subject- and work-based elements more coherently such that engagement in practice is a source of critical and innovative thinking empowering graduates to take the practice of fashion business forward. One approach to updating is to add topics to the core curriculum as topics that should be 'covered'. However, this content-focused approach, associated with learning based on acquisition, has been criticised for its tendency to result in fragmented and superficial coverage and fails to meet the need for collaborative and interdisciplinary thinking (Guile, 2010). However, it is important to note that terms employed to represent learning across the spectrum of cognitive to practical knowledge: acquisition and participation are metaphors and that there is a need for both forms of knowledge. For example, if students are going to contribute to the development of practice, they need theoretical knowledge in order to prevent knowledge becoming specific and localised with no wider value beyond that particular context. In an emerging subdiscipline like fashion developing the disciplinary system of meaning as a condition for using knowledge in that particular context is important – generalisable knowledge relies on conceptual knowledge. It is therefore important that the students learn to distinguish between theory and context forms of knowledge in order to take knowledge from other areas and apply it and to use models and frameworks to illuminate current practice. This study concludes that signature pedagogies can be applied to help support a different approach where the education of future professionals could take an ontological approach to learning and practice and focus on the development of the graduate and then build a forward-facing learning environment to support this 'becoming'.

This thesis concludes by illustrating an alternative pedagogic approach for the emerging sub-discipline of fashion business through the combination of design pedagogy, PLM and communities of practice.

As described in chapter 1, PLM was seen to have much potential as a collaborative and digital learning environment and became an explicit ambition for members of the course team. For many years this ambition remained unrealised and PLM served as a conceptual framework for the modernising ambitions of the course team. The educational partnership for PLM was agreed in order to secure an industry-standard digital learning environment to provide an arena such that students can engage with processes and practices that help them to develop and demonstrate competencies needed for a new era. The partnership has also supported the creation of a PLM-focused learning community by facilitating all the

active involvement of additional external stakeholders in retail brands, associated technology companies and consultants. This chapter concludes that through their membership of a PLM- enabled buying team students benefit from rich forms of learning participation that developed their criticality and enabled them to pursue their own interests and develop connections to the industry. Further, given that PLM adoption in the UK industry is at its early stage with a scarcity of experience in the industry, graduates with PLM skills and knowledge can exploit this competence in competitive jobs markets facilitating their access into the industry.

8.2 Overview

This thesis has shown that the fashion business sector is of great economic and cultural significance and is experiencing a period of rapid transformation due to increasingly volatile patterns of demand, the acceleration and influence of technology and the pressing need to deal with long-standing industry issues relating to worker exploitation and environmental impacts. Alongside these changes, technology is also significantly affecting industrial working practices through the adoption of knowledge management systems such as product life-cycle management (PLM). Accordingly, industry-oriented educational courses must consider how to respond to these challenges in order for graduates to be better prepared for their future professional practice and capable of developing practice.

The extant pedagogic research pertaining to fashion business in higher education outlines many challenges for the future of the discipline with researchers asserting that education must change in accordance with the need for graduates to become change agents and manage industry demands for global citizenship (LeHew and Meyer, 2005; Karpova, Jacobs, Lee and Andrew, 2011; Muhammad and Ha-Brookshire, 2009, p. 42); sustainability, (Pasricha and Kadolph, 2009; Radclyffe-Thomas, Varley and Roncha, 2018) and knowledge of relevant digital technologies (Muhammad and Ha-Brookshire, 2011; Romeo and Lee, 2013).

The central challenge for educators is how to give students a sense of this complex landscape of practice and its histories, regimes and interconnections whilst acknowledging that practice is rapidly evolving. This study responds to this challenge by examining the potential of the introduction of PLM, a computer-based system of manufacturing and the associated systems that support it, to radically transform fashion business degree level education. It shows that by employing PLM it is possible to create a collaborative, forward-facing learning environment within one fashion business course. This intervention adopted

the ontological approach within the pedagogy of design (Orr and Shreeve, 2018; Tovey, 2015) and argues that this offers a unique student experience that has significant potential to develop practitioners with the ability to actively contribute to the development of fashion business practice.

This thesis contributes to the strategic direction of fashion business education though the development of a new, creative, collaborative, participatory and holistic model of learning and teaching of fashion and textiles in order to better prepare graduates to tackle the issues and challenges of industry in the 21st-century with collaborative and interdisciplinary thinking.

8.3 Discussion of the research questions

1. How might PLM support the establishment of a collaborative learning environment and provide a model for teaching and learning of fashion business in higher education?

2. What changes in the learning experience occur as a result of the intervention?

a. How do students experience learning using PLM?

b. What is the contribution that novices can make to an industry in the process of transition?

3. In what ways can Wenger's learning architecture approach be applied to understand the data from this study?

Regarding question one, chapter five illustrated the ways that PLM software can be adopted to establish a community of learning around critical aspects of the work of fashion business practitioners. Further, as the associated retail technologies evolve, PLM is acting as a hub (Terzi et al., 2010) enabling a change in emphasis to be integrated into the future design. The discussion in chapter five illustrated that PLM supported the learning design through the provision of numerous and diverse opportunities to engage in identity work through belonging to a community of learning. PLM provided a focus for the learning community and fostered connections, collaboration and wider networking with near peers, alumni and the wider industry. The collaboration with PTC educational partnership for FlexPLM is considered to have contributed significantly to the development of a community of learning by incentivising participation in the topic and activities and coordinating expertise to support PLM event week. The expertise, support and additional resources made available through the educational partnership enabled the redesign to be rapidly implemented through

collaborative effort. Although the academic team participated in training with PLM the partnership provided expertise during the event week. The PLM community of learning was designed to offer a wide variety of interactions and shared experiences that provided a holistic view of industry processes, made practice transparent, introduced interests and thereby suggested possible trajectories to pursue through higher education, into the workplace and on to full membership in the industry. The variety of interactions was supportive in the negotiation of a professional identity and the transition to the workplace.

This thesis argues that PLM is a powerful tool of collaboration and supports efforts to generate new practices that integrate product innovation with supply chain process innovation and build 'collaborative innovation capacity' (Swink, 2015). Therefore, it is argued that PLM provided an effective vehicle for change in the curriculum and pedagogy of fashion business as evidenced by this thesis. This is not to argue for the specific use of PLM technology per se, but to demonstrate how it was embraced conceptually to help realise the vision of a more forward-facing educational experience.

There is a clear interconnection between research questions one and two that is reflected in the associated findings chapters where learning was first discussed in terms of the structural design of the learning community in chapter five, and then through consideration of the effects of the educational design on the formation of identities in chapter six and seven.

At the practice level, PLM provided a means to map how the curriculum represents a body of knowledge that can be applied in practice thereby bringing coherence and relevance to the curriculum. It was useful for staff to have a visual conception of the way that PLM updates and extends the buying cycle across the full product lifecycle in order to perceive the continuing development of the programme. Through participation in the shared repertoire, the processes and practices are made more transparent and thus open to critique. The implementation of a PLM system provided the opportunity to be a member of a small team mimicking the practices of a product category buying team, to engage in industry practice with their peers and to demonstrate their competence to an external audience. Two artefacts were produced within this module: a tech-pack and a case study and these were specifically designed as boundary objects i.e. to have a perceived value, both academically and in the industry, thereby offering a means to demonstrate and communicate students' professional competence and their potential to contribute to the development of practice. The case studies evidenced the novel and innovative thinking of undergraduates, and demonstrated their peripheral wisdom (Wenger, 1998, p. 216), to contribute to the ongoing change within the industry. Thus, PLM enables students to

develop a holistic perspective of their chosen profession and with this, students are better able to appreciate the interconnected nature of the industry.

Further, working within a mixed cohort group as a product category team to fulfil the immersive brief appears have provided students with a very intense learning experience. The intervention has shown that making space in the timetable is a valuable learning experience which provides the opportunity to learn how to collaborate effectively as well as positively contributing to professional identity formation and a growing sense of confidence in professional competence. External validation made a significant contribution to this identity work facilitating students' independent research investigating the development of future practice. These case studies provided an opportunity for students to apply an academic and theoretical knowledge to propose how practice may evolve, emphasising the importance of conceptual knowledge in the development of practice. This intervention has asserted the significance of "becoming" central to the pedagogy of design to demonstrate the importance of preserving the unique learning experience fostered by design pedagogy in order to support the successful transition through education and onto the workplace. The model presented here offers a mechanism to preserve these distinctive principles and address the learning needs of 21st century undergraduates and the associated industry.

Regarding question three, Wenger's (1998) learning architectures derived from his theory of the communities of practice has been demonstrated as helpful to the design and facilitation of learning communities. Wenger's (1998) communities of practice theoretical framework provided the conceptual direction of this intervention and enabled a theoretical understanding of the learning space developed through this intervention. The notions of communities of practice and learning architectures are clearly aligned with an action research methodology: the learning architecture is a powerful analytical tool to understand improvement (action) and to then theoretically consider formal teaching within a community of practice (research). The learning architecture concept makes a valuable contribution to pedagogy in terms of helping to provide a more formalized approach to design but also as a tool of analysis and reflection. The infrastructural component, modes of belonging, proved a particularly useful analytical tool to understand the data relating to transition and to suggest where improvements could be made. This thesis aligns with the findings of in the extant literature (Brosnan and Burgess, 2002; Cousin and Deepwell, 2005; Lees and Meyer, 2011; Scanlan, 2013; Sorensen and Murchú, 2004; Tummons, 2014, 2018; Waycott, Thompson, Sheard and Clerehan, 2017) in recommending the use of Wenger's (1998) learning architecture to other practitioners seeking to evaluate the effectiveness of changes in pedagogy particularly those that aim to develop students' professional identity in vocational

courses. A learning architecture approach brings a more structured and robust approach to the notion of communities of practice that its previously intuitive application (Tummons, 2018). This thesis provides an example of Wenger's (1998) communities of practice and learning architectures recontextualised in the subdiscipline of fashion business education and therefore contributes to knowledge through the application of this theory.

8.4 Contribution to practice

This thesis is a response to calls in the extant educational literature for change within fashion business education such that graduates are better prepared to meet the demands for global citizenship (LeHew and Meyer, 2005; Karpova, Jacobs, Lee and Andrew, 2011; Muhammad and Ha-Brookshire, 2009, p. 42); sustainability (Pasricha and Kadolph, 2009; Radclyffe-Thomas, Varley and Roncha, 2018) through an awareness of holism and system thinking (Fletcher and Williams, 2013), tolerance of uncertainty (Tovey and Bull, 2010), knowledge of relevant digital technologies (Muhammad and Ha-Brookshire, 2011; Romeo and Lee, 2013) and use of theory (Wright and Gilmore, 2012). It outlines an alternative approach, consistent with the principles of the pedagogy of design, that resists the tendency to add more content to the curriculum. This thesis offers a close-up perspective of insider practitioner research, as called for by Laurillard (2013) and thereby makes a contribution to the knowledge of educational practice. It also demonstrates the applicability and value of the methodology of action research to collaborative and change projects in higher education. A number of principles that are transferrable are discussed below.

The formation of a collaborative, educational partnership between the University and PTC made this intervention possible and the involvement of external stakeholders expanded the community of practice and benefitted the learning for the students; there is clearly significance in forming an educational partnership to deliver change. As the lead practitioner, my vision based around the development of future practitioners was emphasised within this partnership. Adoption of the notions of communities of practice (Wenger, 1998) and legitimate peripheral practice (Lave and Wenger, 1991) enabled a focus on the educational perspective in the intervention rather than a focus on the technology or the partnership. This pedagogic approach helped illuminate and emphasise the identity work that students undertake as they are apprenticed into the industry rather than updates required to the curriculum.

As far as the external stakeholders are aware, this is the first thesis to report integrating PLM (a knowledge management system) into undergraduate fashion business education.

The fashion business sector is undergoing a seismic shift termed a digital transformation known as Industry 4.0 and this study appears to have a potential for long-term impact on the careers of the participants of this study and the organisations where they become a member. The findings suggest there is much potential in the contribution of graduates with knowledge of relevant digital technologies for an industry in rapid transition. For practitioners it offers a conceptual approach to identifying how change might be implemented within comparable courses. This may have applicability more broadly, for general business and management studies, given it is increasingly apparent that knowledge management systems (KMS) will form the working environment of a range of practitioners in a number of sectors for instance engineering, manufacturing, construction and the public sector (Dalkir, 2017, p.505). This intervention has shown how it is possible to design a learning environment around KMS to provide an environment within which students can learn creatively and at sustainable cost.

The notion of 'boundary objects' makes an important contribution towards the generalisability of this study. As is illustrated in 5.2.3, this intervention employed the 'tech-pack' as a suitable boundary object within a global sourcing module. However, there are many other potential boundary objects within fashion and textiles that could be utilised to achieve an alternative emphasis. Equally, the case study to investigate how practice may be taken forward provides an opportunity for students to apply their theoretical knowledge to develop innovation and creative solutions and to present this as a boundary object at interview.

As discussed in relation to the research questions, the immersive brief appears have provided students with a very intense learning experience. It is argued that making space in the timetable, for example by utilising reading weeks, provides a valuable opportunity to learn how to collaborate effectively as well as positively contributing to professional identity formation and a growing sense of confidence in professional competence.

The fashion industry has many ethical and environmental challenges and there is a need for change agents (Pasricha and Kadolph, 2009) to deliver solutions for these industry problems. As discussed in chapter four, whilst this intervention did not set out to foreground praxis or an agenda of sustainability, these particular topics have been opened up for consideration during the intervention. Hence, the analysis implies that wider topics might be encouraged indirectly through the experiences and interactions in a learning community. This would also strengthen the moral apprenticeship (Shulman, 2005) i.e. learning to think and act with integrity, within the signature pedagogy of design.

8.5 Further recommendations

The students' recollections of their most powerful learning experiences, for example the WhichPLM Academy and the PLM event week were additional, optional sessions to the planned timetable. However, it appears important to maintain space in teaching and learning plans to respond to such opportunities. The learning architecture analysis helped to elucidate that the 'designed and emergent' (Wenger, 1998, p. 232) components of any learning design are in tension. Consequently, educational reification in the form of schemes of work, over-packed curricula etc., inevitably constrain and obscure opportunities for learning that is responsive or emergent and could have detrimental, unforeseen effects. The impact of a lack of openness is also pertinent in terms of assessment tasks; unless curricula remain broad enough such that students can explore widely, pursuing their interests, there is a risk that students will not fully engage in their learning and potential career trajectories become closed off.

The findings suggest that there are some shared characteristics within these 'early adopters' group of students. These characteristics - opportunity spotting, tolerance of ambiguity and commitment to learning are in line with literature of enterprise pedagogy (Jones and Iredale, 2010; Kubberød and Pettersen, 2018). As outlined in section 6.5, managed reflection and career development planning could appear to be supportive of the development of these characteristics in the emerging identity of students. This is seen as significant mechanism that enhances the learning for students involved in the iterations of this intervention.

The significance of enabling the interaction with near peers, or students from the same course but at different levels, through shared tasks to facilitate exposure to 'paradigmatic trajectories' (Wenger, 1998, p. 238) or the vicarious experiences and visible career paths of other students was explored in section 7.3. It is argued that for fashion business courses, 'near peers' or students from the same course but at different levels are a readily available and largely untapped resource that could be developed further to have mutual benefits for all involved.

The immersive brief of PLM event week was motivational to learning. This suggests a mechanism to give external exposure to the peripheral wisdom (Wenger, 1998, p. 216) of students that could be of benefit to the industry by helping to fill the void of knowledge around emerging technologies for the retail sector. It could provide a regular source of information, ideas and feedback similar to the reporting structure of the shadow committee or board described in section 7.5.

8.6 Further research

Whilst it is acknowledged that the findings of this intervention are limited due to its small size and single context, in this section, it is argued that this thesis makes a contribution to practice in a number of ways although further research is needed to explore how these findings can be applied in other educational and organisational contexts. A number of areas where there is potential for further research can be noted.

As far as the external stakeholders are aware, this is the first example of PLM implementation into an undergraduate fashion business course. However, the software provider, is currently supporting other universities interests in PLM. In due course, it would be useful to conduct a comparative case study with these other fashion business courses to compare focus, approaches and outcomes.

Further, the connectivity of PLM allows for different institutions to work collaboratively together on a project. This was achieved within engineering by Mejía-Gutiérrez et al., (2014) as discussed in section 3.3.2. Therefore, a research project to link these fashion courses together through PLM could be used to design collaborative learning experiences across different institutions sharing specialisms and even giving students a global and co-cultural experience would be interesting to pursue. As PLM extends to more fully cover the full life-cycle a research project to design collaborative learning experiences to support a shift to a circular economy would be a powerful application of PLM.

The learning architectures approach has proved a useful tool of analysis and reflection pertaining to the emergence of a professional identity during the transition through a higher education course. It is viewed that it would also be a useful analytical tool to understand the data from other studies

#involving a transition such as the transition from college to university and the transition from University to the workplace to provide insight into how these might be better supported.

Aligned with the area of sustainability it would be valuable to research further in the development of a new mind-set by further consideration of the moral apprenticeship (Shulman, 2005) and the need to relate this to explicit 'rules of the game' rather than a topic centred approach (Wright and Gilmore, 2012). There are parallels in the disorientation of negotiating this new identity within a community of practice and threshold concepts (Tummons 2018, p. 80). This could potentially illuminate stuck points in the curriculum i.e. investigating whether issues pertaining to the development of a new mind-set relate to stuck points or portal concepts that could be investigated through the notion of liminality.

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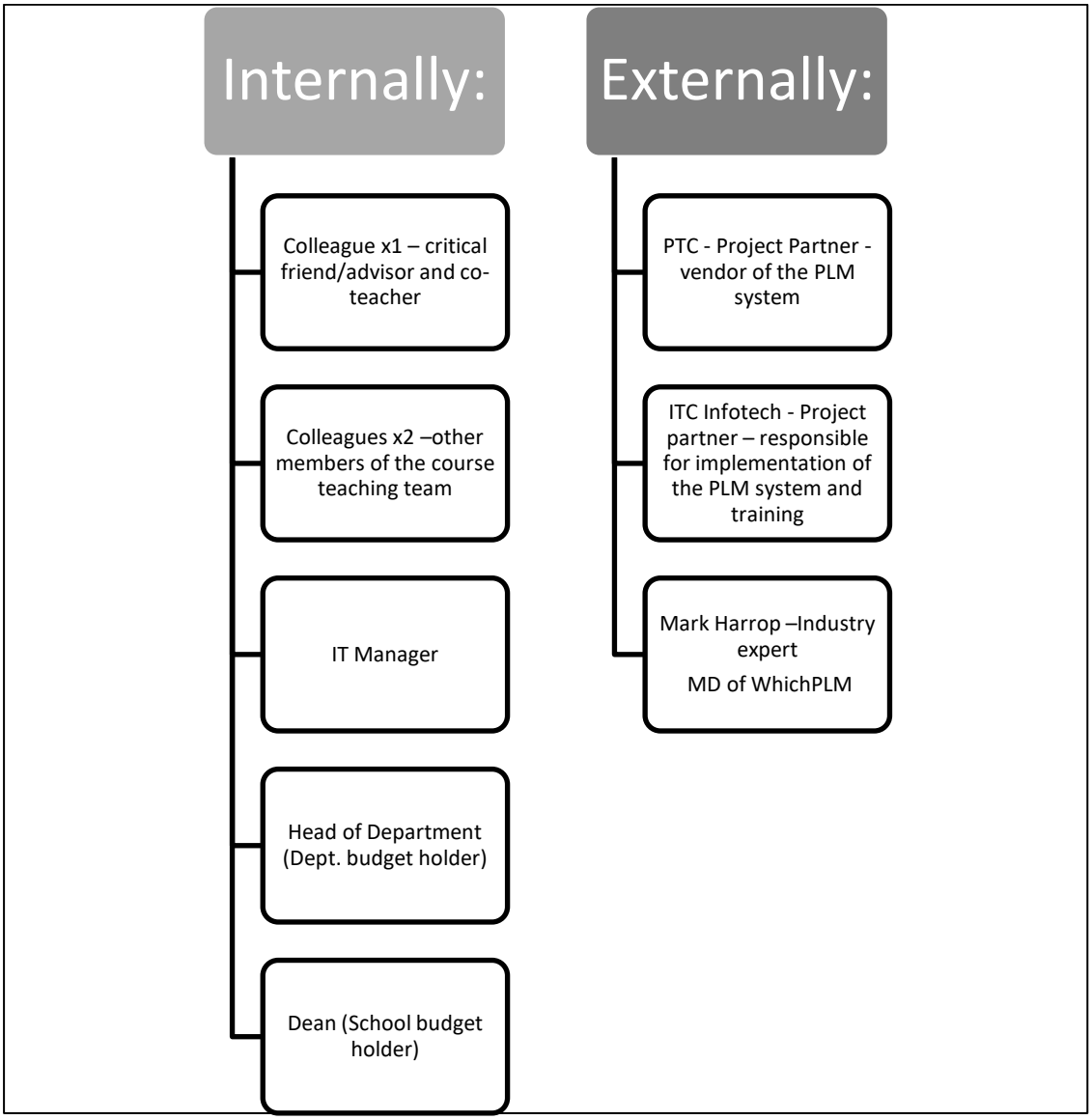
Appendices

Appendix 1 List of internal and external stakeholders



Appendix 2 A literature review of PLM in the RFA sector (2000 – 2016)

From PLM 1.0 to PLM 2.0: The evolving role of product life-cycle management (PLM) in the textile and apparel industries, a literature review of PLM in the retail, footwear, and apparel (RFA) sector (2000 – 2016) **Purpose -** Product life-cycle management (PLM) is an enterprise-wide strategy and has gained prominence across the manufacturing sector. The fashion industry is a late adopter of PLM, yet within global retail brands PLM is now

Appendix 2 Literature Review

Full article can be found: Conlon, J. (2019a). **From PLM 1.0 to PLM 2.0: The evolving role of product life-cycle management (PLM) in the textile and apparel industries, a literature review of PLM in the retail, footwear, and apparel (RFA) sector (2000 – 2018)**', *Journal of Fashion Marketing and Management: An International Journal.* DOI (10.1108/JFMM-12-2017-0143)

Abstract:

From PLM 1.0 to PLM 2.0: The evolving role of product life-cycle management (PLM) in the textile and apparel industries, a literature review of PLM in the fashion and textiles sector (2000 – 2018)

Purpose - Product lifecycle management (PLM) is an enterprise-wide strategy gaining prominence across manufacturing. The fashion industry is a late adopter of PLM, yet within global fashion and textile organisations PLM is now becoming a mainstream approach to optimize core processes. This literature review analyses the latest academic research to establish a broad basis of understanding of PLM in the sector and identify potential future research directions.

Design/methodology/approach: The author presents a systematic literature review undertaken to investigate the current state and main perspectives of research on PLM in the fashion and textiles sector. The paper adopts the three features (managerial, technological and collaborative) of the definition of PLM by Corallo et al. (2013) as the analytic framework for the 27 papers in the sector to illustrate how PLM is currently framed and conceptualised in the sector before discussing the key themes that have emerged within these academic studies.

Findings: PLM is at an interesting phase as it evolves from classical PLM 1.0 to connected PLM 2.0. Authors agree that businesses in the fashion and textiles sector are late adopters of PLM. The evolution of PLM from its PDM origins as an IT tool to a critical component of the strategy for digital transformation is reported. The strategic role of suppliers is noted as a critical success factor. Key inhibitors relating to PLM adoption and optimization in the sector are identified as limited holistic and theoretical perspectives of PLM coupled with a deficiency in relevant industry skills. It is argued that the transformational potential of PLM 2.0 may not be fully realised without a more coordinated development effort through industrial and academic collaboration.

Research limitations: The limitations of this study are that it is a literature review of academic papers in the RFA sector papers within the timescale 2000-2018. PLM 1.0 has dominated in this time period however the potential trajectory of connected PLM 2.0 is beginning to emerge.

Practical implications: The results from this paper indicate that there is a lack of research on PLM in the sector and concludes by suggesting promising future research possibilities: further empirical and case studies on organisations implementing a PLM strategy; studies reporting on the contribution of PLM to address the challenges of sustainability, traceability and transparency in the industry and inter-industry collaborations; studies with knowledge management theories specifically applied to the fashion and textile sector; and the opportunity for academic and industry collaboration on the development of PLM to meet these needs.

Originality/value: To the best of the author's knowledge, no systematic literature review on this topic has previously been published in academic journals. Given levels of investment in PLM platforms in the sector, both practitioners in companies and the academic community might find the review and agenda for future research useful.

Keywords literature review, product life-cycle management (PLM), retail, apparel, fashion industry, textiles, digital, business transformation, Web 2.0,

Paper type literature review

Appendix 3 WhichPLM editorial

Retrieved from https://www.whichplm.com/plm-for-fashion-the-importance-of-education/

whichPLM

PLM FOR FASHION: THE IMPORTANCE OF EDUCATION

At the beginning of this month WhichPLM's Founder and MD, Mark Harrop, and WhichPLM Editorial Board member and Independent Advisor, Morag Ashworth, paid a visit to the University of Huddersfield to attend and participate in a PLM focused workshop. This is Morag's exclusive report.

Jo Conlon, Senior Lecturer in Fashion & Textiles at the University of Huddersfield, invited WhichPLM to the establishment early November to attend a classroom session; the session comprised around 25 students, lecturers including Jo, course leaders and, of course, WhichPLM's Mark Harrop and I. All students were enrolled on the Buying Management BA (Hons) course and all were into their second year of study.

The reason for this specific session? Further development through education. WhichPLM was called in to help students develop their knowledge and understanding of the opportunities, challenges and benefits of a modern day PLM solution. Education has been the overriding goal for WhichPLM since it's inception, and what better place to impart the vast

knowledge accrued over decades past, than a university?

Upon arriving at the session, the usual introductions were made and we were welcomed warmly. The students had been split into seven groups, each with three to four members, during the previous class. In preparation for our session each group had been asked to research a different PLM supplier; in our session they were to deliver their findings in the form of a supplier analysis and business case.

In turn, each team presented a summary of their preliminary investigation, which included: the company origin and brief history, some statistics, the key marketplace, market share and some key customer names. The students also explained some key system features and functionalities, advantages and disadvantages (in other words, the pros and cons for each solution), SWOT analysis, a summary, and concluding speech.

This article isn't designed to replicate the students' presentations; it hasn't been written to talk up or indeed talk down any one supplier or one solution, but rather to report on the level of knowledge (and in some cases the level of misinformation) the students already possessed. Considering it was not possible for any of the groups to actually view the software they were presenting on, each team managed to present a good understanding of the basic functionality of a PLM system.

Whilst Mark and I were truly impressed by the knowledge each team displayed, at the same time we were slightly bemused by some of the 'marketing speak' that had been taken as fact. One example would be the marketing spin surrounding rapid implementation. Students were led to believe that a PLM solution could be implemented in as little as twelve weeks, including all of the necessary preparation. Said preparation includes the business case, process maturity, ROI (return on investment) calculations and analysis, master data refinement, configuration, implementation, training, testing, and going live with the solution. In reality, we know this is not the case.

A twelve-week target is simply not realistic when we take into account the sheer magnitude of work that must be undertaken when preparing for, and implementing a PLM solution. That the students accepted this statement as fact only reinforces the damage that underhanded marketing can play in the apparel marketplace; we are constantly dealing with actual PLM customers who have had the wool pulled over their eyes when it comes to understanding the real depth of planning and introspection that goes into a PLM project, and who are bewildered when their project fails to deliver against the words in their PLM supplier's brochure.

This isn't to put readers considering undergoing the selection and implementation process off doing so, but it is simply to make such a reader aware of the facts at the outset. I cannot stress enough the importance of planning: plan, plan again, and then plan some more.

After each presentation, Mark and I critiqued the analysis and assumptions that each team made, providing expert feedback from decades of experience and using some real-life situations as examples to cement our points. I suppose a lot of this feedback could be categorised under "*The things a PLM supplier will never tell you*". As a duo, Mark focused on explaining more clearly the attributes of each supplier, whilst I focused on the reality of business processes.

Following the day's session was the obligatory Q&A, and what was apparent was just how knowledgeable this group in fact was. Mark and I were delighted with the level of enthusiasm and commitment coming from each student, and with the glowing feedback we received from the lecturers and course leaders.

After such a successful session, I am thrilled to announce that WhichPLM have agreed to work with Huddersfield University on a continuous basis. The partnership begins with our commitment to granting the team access to exclusive WhichPLM content, and to assist them in developing the material necessary for a PLM subject matter module to be included in their course next year.

We are extremely excited to see a university like Huddersfield leading the way in developing one of the first PLM-specific fashion courses – a course that we hope will play a large part towards setting a formal qualification around the subject of PLM in the retail, footwear and apparel space.

Senior Lecturer, Jo Conlon, had some kind words to say on the matter: "We recognise the opportunity that PLM represents for the industry and are keen to see our graduates enter employment with a rich understanding of PLM. We are grateful for the generous support of WhichPLM as we embed PLM software into the curriculum."

Mark and I were (and are) delighted to be given the opportunity to help educate the generation of tomorrow, and we would like to thank the lecturers and course leaders for making the day happen and for making the future possible, and the students for their superb work.

Thank you Jo Conlon, Andrew Taylor, Jane Ritchie and Rosemary Wilkin; Harriet Boyden, Kelly Brown, Faye Carter, Rebecca Charlton, Chloe Egley, Lois Elliot, Hannah Fox, Susana Gideon, Katie Johnson, Danielle Kay, Ashleigh King, Lewis Lane, Kate Lingard, Clare Linsey, Laura Mcmahon, Charlotte Napper, Billie Nixon, Chelsea O'Connor, Stella Robson, Jaime Sandlands, Ellen-Kate Sexton, Alexandra Todd, Gemma Townend, and Rebecca Welsby.

Appendix 4 WhichPLM article

Retrieved from https://www.whichplm.com/the-future-is-always-now-evolving-lifecycles-in-fashion/

whichPLM

The Future is Always Now; Evolving Lifecycles in Fashion

Jo Conlon & Andrew Taylor, both Senior Lecturers at the University of Huddersfield, share their first exclusive guest blog with us. The duo discusses the education around technology in fashion, and the journey UoH has undergone to add PLM to the curriculum, as well as their plans to blur the lines between higher education and industry in the future.

Fashion has forever been characterized by change, volatility, complexity and dynamism, yet the mainstream fashion of the past was seasonally predictable. Today, it is unrecognisable, mutating rapidly beyond the limits of our collective imaginations.

What is driving and accelerating ongoing change today? Technology is primarily fueling our collective, addictive drive for accessing the latest trends; all of this is in our hands and at the touch or swipe of a super vivid screen we are immersed in personal devices giving the consumer the power to increase demand and, with this, transform the retail industry.

In education we are increasingly aware that CAD & CAM is resigned to Fashion history. IoT and mobile technologies are omnipotent, pervasive, real world power tools of the buyer, the merchandiser and the retailer, as they stylishly fit in the creative hand of the millennial professional, which affects and influences all aspects of our everyday lives. We expect to pull, stream, push and transfer data everywhere. Our undergraduate young professionals live in a world where computers and the Internet have always been on and accessible. Most students have grown up with desktop computers in the home and have used several different mobile phones during their early teens.

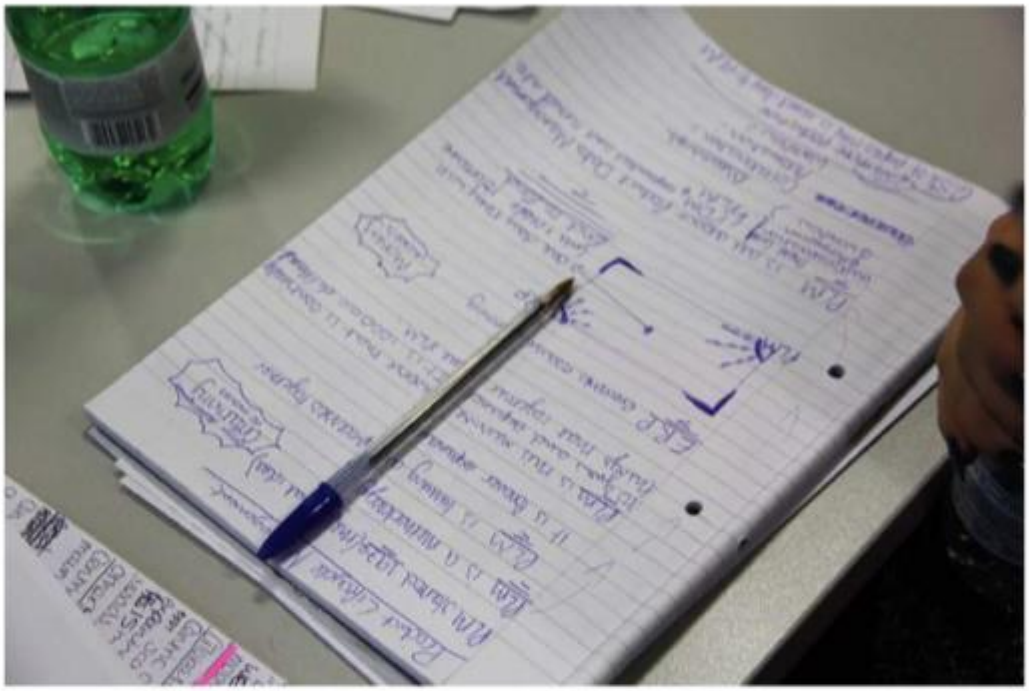
Since the inception of the University of Huddersfield's BA Fashion Textiles Buying Management course in 2004 the content of the curriculum has, like many fashion business programmes, predominantly delivered theoretical knowledge of the industry and its global complexities by various traditional channels: PowerPoint lectures, finance scenarios, visits and guest speaker activities (including multiple visits from WhichPLM), with foundation skills development in digital focused creative practice workshops, using technology to present trends, source fabric, develop and communicate ranges professionally in MS Office and the Adobe Creative Suite.

The Fashion Textiles Buying Management team at the University of Huddersfield has recognized that, today, PLM frames professional practice and offers an affordance for curriculum transformation. We have created a new, and we believe unique, learning programme for the next generation of industry professionals by using PLM as a framework and a platform to re-think the learning design of the course and to model wider future educational practice. PLM provides a framework that permeates all aspects of the body of knowledge and provides a holistic view of industry processes, an up-to-date context for study within a supportive network and the opportunity to critique traditional practices and thereby generate new practices.

From 2005, through our research and increased exposure to industry technologies in 3D product and scanning with pro-active high-end industry collaborations, we encouraged new uses of technology aligned with broader, real world practices to be introduced into the programme. Given the fast pace of technology developments and increasing investment in fashion-specific PLM solutions by retailers and brands, we realized its value and were keen to introduce PLM education at all levels in the programme to ensure that our graduates enter employment with a baseline of PLM knowledge, recognising the realistic solutions it can generate, the problems it can solve and opportunities it can provide. Therefore, PLM had to be at the centre of the future education programme as an immersive experience simulating industry practice not as an under-utilised monolithic software installation. What was sought through curriculum innovation was the development of a mindset capable of utilizing technological innovations to critique existing processes and practices and create alternatives that respond to the demands and opportunities of new times, new needs and changes in circumstances.

Two internal bids for investment in PLM building on an existing educational partnership for fashion industry

CAD design were initiated in 2006 and 2009, but these were unsupported as it was unclear how PLM could be integrated effectively.



As in industry, securing funding is not the only challenge for this type of transition from PDM to PLM. It is not as simple as adopting a technology, a clear vision of its use is required. PLM must be seen as an approach or methodology that supports an enterprise-wide strategy or equally to support a broad curriculum. Mirroring industry, courses traditionally also have a function-focus perpetuating a "functional – silo" view. Additionally, any practical sessions on the software are typically based on the software vendor's training packages, which reinforce the technical and functional aspects of the system rather than provide a holistic business management experience. Furthermore, the accelerated pace of software development makes teaching expertise unlikely and up-skilling a challenge when software is perpetually evolving. Unlike industry there are no ROI calculators for PLM in education, making a business case for transforming the curriculum difficult.

Though without the necessary funding support we were unable to access the PLM solution, we strongly felt the migration to PLM and associated interconnected digital design and manufacture technologies was necessary. From 2009, a conceptual framework of PLM in conjunction with open source collaborative software was devised to reconfigure a second year module mimicking industry processes and practices and displaying the interconnected nature of the elements in the process. This first iteration was part of Masters level study disseminated at UCA. This augmented a new working reality for our students, where they experimented with software of their own choice, providing them with the necessary foundations to go into industry to embrace new technologies including PLM with confidence.

Although this first reconceptualization was successful, attending the 2011 DS UK PLM Forum was pivotal. WhichPLM's CEO & Founder, Mark Harrop, presented a convincing argument that a proprietary PLM solution was necessary in order to provide the enterprise-wide backbone on which other technologies would increasingly connect. Given the pace of change in both the industry and technology, there is certainly a place for free to use tools, but there was clear evidence that our future graduates' working environment would be within a PLM

system and therefore this should be included in our educational programme. As the influencers of the future, our students can then go on to imagine how to connect these technologies together creating significant efficiencies and proposing radical changes to the existing system.

An educational partnership was formed with PTC for FlexPLM in 2014 and this was integrated into second year teaching on the Fashion Buying Management programme in 2014-15. The programme for learning was a blend of traditional lectures, extracurricular WhichPLM Academy study, hands-on sessions in FlexPLM, global industry guest lectures and student research into PLM. We did not want to simply add PLM as another topic to the curriculum. We sought an immersive experience whereby our students could work collaboratively within a PLM system, simulating their future working environment.

Participation in the WhichPLM Academy remains a key feature, with students benefiting from external in-depth knowledge and expertise that captures the history of PDM, CPM, PLM and the strategic use of PLM for the future. By participating in the WhichPLM Academy we believe our students benefit from a unique learning experience that has been carefully and generously developed to empower them with a depth of understanding that you can only gain from true experts. A particularly outstanding feature is that it is designed for the RFA sector and is future-focused. Danielle Newman, a current second year, commented on gaining her bronze certification that the experience was all insightful and she was reassured that the course was up-to-date with industry, as the source was from an industry professional service. The experience has given her a real advantage with future employment as it has increased her knowledge of the PLM systems available and how they are changing the face of the fashion industry. She said that her student group found Mark's most recent talk very useful as it covered, in depth, how PLM affects all sectors in the fashion industry. She also added that it was very beneficial to the first year students who are new to PLM, as his talk has put their PLM assignment into context of industry.

Going "live" in 2014 with PTC's FlexPLM was instrumental in transforming the programme. Included in this first year was a "live" PLM event, which created an opportunity for all Buying Management undergraduates to understand more about PLM. Students worked in product category development teams to create a product range for George at Asda, using FlexPLM to source, collate and manage information on inspiration, trends, materials,

sourcing, sizing and proposed line plan budgets. Each business group presented their final proposals to a guest industry panel. A final year participant said: "The event week was insightful on many levels. Working with other years on the project was very enjoyable and a fantastic opportunity to network with industry leaders. Having minimal knowledge of PLM systems to begin with, we now have a good insight to how the system is integrated into the industry and it has opened new doors for us in research and career prospects. A great week to be a part of!"

In turn, these activities have prompted students' future research interests allowing them to create and innovate with emerging technologies. They have produced case studies and dissertations that articulate and visualise future use-cases, actively investigating the potential of technologies such as PLM in association with the associated technologies of 3D, the IoT, data analytics and social media. Using a phased implementation model in the following academic years, 2015–16 and 2016-17, PLM has been further integrated to frame at least **one third of study within the programme**. Our students now benefit from an integrated, industry technology focused, learning experience. This provides a strong framework for learners to connect their learning and work placement experiences and to research together exploring strategic, real world applied opportunities for extended and innovative PLM technologies. The most valuable benefits we see of integrating PLM into the program are in its power to nurture creative and innovative networking.

This ongoing partnership and the associated curriculum transformation all are the basis for Jo Conlon's doctoral research – a professional doctorate in education, investigating how a PLM approach can reshape fashion business education and present a case study of learning in this landscape of practice. This research illustrates a learning design model transforming the curriculum to better prepare all students for occupational practice, and empower them to question embedded conventions, create radical changes to the existing system, embark on new careers and to be confident in their abilities to make positive contribution to the industry and their communities.

Following establishing PLM as a platform in the curriculum, we now anticipate the emerging possibilities of extended functionality of PLM in association with other business software solutions, the emerging opportunities of extended-PLM, that integrate consumer feedback to inform buying decisions, virtual sampling in 2D and 3D in partnership with Optitex to reduce lead-times and waste. This also provides the opportunity for connecting applications and data analytics, and the IoT to inform buying decisions.

Next, in an era of smart, connected products we intend to establish a community of smart connected learners, working collaboratively within a data driven system. We need opportunities for our students to hear first-hand experiences, to observe and influence PLM implementations, and to be more active and valued members within the industry. We seek to dissolve the boundaries between higher education and industry where outward and future facing, confident individuals work together on reimagining possibilities for the future industry, thriving and striving for better business outcomes in the new data and tool-rich environment. What past and new and emerging technologies have and will influence the way we work in the future?

Appendix 5 WhichPLM article

Retrieved from https://www.whichplm.com/enterprise-3d-an-education/

Enterprise 3D: an education

In this report our Editor, Lydia Hanson, comments on a recent visit WhichPLM made to the University of Huddersfield. This came not long after a trip to Manchester Metropolitan University in February 2016.

WhichPLM has made regular visits to the University of Huddersfield for the best part of two years; our CEO has spent time participating in guest lectures spanning a range of topics – topics linked to PLM for fashion, 3D and, now, the 'Internet of Things'.

On the first day of this month, Mark Harrop returned to UoH to catch-up with second year students on the fashion course.

The Department of Fashion and Textiles at UoH aims to be recognized as a global area of excellence in fashion/textile teaching and learning, technology, innovation and research. It presents opportunities for the two closely related disciplines to develop and work closely together. This includes the fusion of staff and spreading of skills and specialist knowledge in the exciting development of courses, modules, projects, research and enterprise.

The department has achieved recognition for its merging of traditional technologies with new and digital technology – something WhichPLM is an advocate for – and aims to maintain this reputation as well as being recognized for excellence in making, craft, skill and business, promotion and marketing.

Having covered PLM at the university a handful of times already, Mark's most recent guest lecture focused on 'Enterprise 3D'. Mark examined the use of 3D technologies operating across a broad range of merchandise and, at the same time, across the entire supply chain. He began by looking back over the last decade and a half (of which he's been involved in 3D) for the fashion sector, and even further back to the use of 3D in other industries such as aerospace, automotive and medicine.

He made the point that there is no 'one size fits all' when it comes to 3D; there is no one solution that can support the needs of a typical retailer, brand or manufacturer. He used the illustration above [originally featured in WhichPLM's 5th Edition Report] to point to the various product types that are now benefitting from the use of 3D in design and manufacturing.

Mark continued to share the origins of 3D for fashion. With 3D having begun in the footwear sector, he shared his own experience of working on 3D last designs in the mid-80s. Microdynamics – an American technology company employing Mark some decades ago – designed and sold a range of FDS (Footwear Design Solutions), including the first footwear CAD systems for creative design and texture mapping; and 2D pattern design systems, followed by 3D last and heal design solutions.

*Images copyright Romans CAD, & Julian Fournié

As well as the image above, WhichPLM has been supplied with some fantastic resources for the purposes of spreading the story of 3D for fashion which, as this lecture continued, began for apparel in the late 1990s with companies like Browzwear and Optitex.

Mark shared the technological challenges during the '90s, and the maturity (or lack thereof) of the solutions and the limitations of hardware and memory. These factors prevented most businesses from adopting 3D solutions – those that did were retail/brand technology leaders with the vision of (and cash to invest in) the future of 3D.

Bringing the pitch back to the present, Mark examined many of the challenges and benefits of using and implementing 3D solutions today. He used several true examples of best practice 'use cases'. He emphasized how crucial it is for a company to look at a 3D project with as much enthusiasm and importance as they would an ERP or PLM project. Today, 3D touches a myriad of different product types, departments and processes (apparel, handbags, footwear, jewellery, watches, consumer electronics and wearables) operating across the entire supply chain. Mark gave real examples linked to areas including creative design, merchandising, synthetic costing, sustainability, near-shoring, CGI (computer generated images), 3D in marketing, supporting mass customization and configuration, and 24 hour sampling.

Mark concluded by sharing his thoughts on what to expect in the not-too-distant future. He used examples of how we can expect to see CGI, Virtual and Augmented reality within retailers, brands and manufactures, in creative design, product development and procurement of apparel.

What followed was what could only be described as a lengthy Q&A session; due to the interest coming from the students this session was detailed and thorough. That interest stems from previous WhichPLM guest lectures, and completion of the WhichPLM Academy bronze tier. In fact, several students were presented with their WhichPLM Academy certifications following the lecture.

And it wasn't just the students who had something to smile about. Jo Conlon [pictured farthest right], Senior Lecturer in Fashion & Textiles, has completed the entire course and was presented with her gold level certification. Jo has been taking the WhichPLM Academy course in recent months, and is the first lecturer to have completed and passed every exam. She shared with us her thoughts on the course, "By participating in the WhichPLM Academy you benefit from a unique learning experience that has been carefully and generously developed to empower you with a depth of understanding that you can only gain from true experts. I particularly like that it is designed for the RFA sector and is future-focussed."

It's easy to see the quality of understanding of PLM from her students; it is apparent that they are all benefitting from her enthusiasm for the subject of PLM and 3D and now the new interest in the IoT and how it will help to transform our industry.

**The images used within the tablets in this article are copyright Romans CAD, & Julien Fournié for Dassault Systèmes.*

Appendix 6 WhichPLM article

Retrieved from https://www.whichplm.com/supporting-tomorrows-retail-professionals-one-year-on/

whichPLM

Supporting Tomorrow's Retail Professionals: One Year On

Just under one year ago, WhichPLM established a strong relationship with the University of Huddersfield (UoH). At the beginning of November, WhichPLM's CEO & Founder, Mark Harrop, paid the University another visit.

In November 2014, two WhichPLM representatives were invited to the University of Huddersfield, to attend and participate in a PLM-focused education programme. WhichPLM was thrilled to see a university like Huddersfield leading the way in developing one of the first PLM-specific fashion courses – a course which we hoped would play a large part towards setting a formal education and qualification around the subject of PLM & E-PLM (Extended-PLM) in the retail, footwear, and apparel space.

Mark Harrop, paid a second and third visit to the university in March of this year, just days apart. The 'PLM event week' in March was the culmination of an educational PLM project organized by Jo Conlon, Senior Lecturer in Fashion & Textiles at the University of Huddersfield, and Mark was invited to pass on some of his expertise, and help judge each of the students' PLM research projects and portfolios on competition day.

In early November 2015, just one year on from our first visit, Mark was invited back to UoH to see the huge strides the University has already taken to include PLM for Fashion in their curriculum.

Senior lecturer, Jo Conlon, is an advocate for the importance of PLM-specific education at the university level. She states, "given the fast pace of technology developments and the increasing investment in fashion-specific PLM solutions by retailers, brands and manufactures, we were keen to introduce PLM education at all levels in the programme. This ensures that our graduates enter employment with a baseline of PLM knowledge,

recognising the realistic solutions that PLM can generate, the problems it can solve and the additional opportunities it can provide."

In 2014 the university implemented PTC's FlexPLM system into the second year course for BA (Hons) Fashion Buying Management. The university believes, and we agree, that this has created a unique learning programme for the next generation of industry professionals that will have the advantage of understanding the critical requirements of a business as it relates to the subject of PLM & E-PLM.

Part of this programme included participation in WhichPLM Academy's bronze level. The bronze modules provide industry best practice for understanding how to make a business case for PLM and how to implement PLM effectively. Jo explains, "our students are now able to differentiate themselves from the crowd with this external certification and their knowledge and enthusiasm for PLM solutions in the workplace. Recently, several graduates and placement students have been back in contact with me to inform me that they are now participating in the evaluation and implementation of PLM within their workplace!"

So, with such a positive outcome since our last visit, Mark was delighted to return to the university and speak with an entirely new set of students. 2015 marks the second year of the implementation; Mark was invited to witness a whole new round of presentations from 2015's second year students, who have worked in small teams to critically evaluate the various PLM solutions available. Mark discussed with each team their findings and understanding, giving them the benefit of his extensive experience and direction.

The university's 2015/16 programme will include the opportunity to work with Optitex 3D software, as the course encourages students to think beyond PLM to E-PLM. Huddersfield students can now benefit from a tiered integrated industry, technology-focused learning experience, firstly as individual users of the FlexPLM 10.2 system, then at a process management level, and finally exploring strategic, real-world, applied opportunities for extended and innovative PLM technologies.

Jo Conlon has found this experience invaluable: "We have benefited enormously from the expertise and commitment of several partners in this project – WhichPLM, PTC, ITC Infotech, George at Asda – to support and embed each stage, developing a rich understanding of PLM as a holistic business process solution. We are extremely grateful for all the generous support as we continue to embed PLM into the curriculum and we would be glad to hear from anyone who would like to know more or be involved in similar educational PLM programs.

"We are delighted with the outcome of this project to date, we believe it will enhance the currency of the programme, inspire and evolve new directions for potential career development of our graduates and support the success of

future PLM initiatives. Our students are already reporting PLM knowledge as a key differentiator in competitive employment markets and their knowledge and PLM-focused enthusiasm to make a positive contribution in the industry."

We are delighted that, just one year since our first visit, the students at the University of Huddersfield are already reaping the benefits a PLM-focused education can offer. We'd like to commend everyone involved; integrating PLM into the curriculum at a university level is a sure-fire way to ensure that graduates are stepping out into the industry armed with the knowledge necessary to gain employment, and make an impact on the future of the fashion industry.

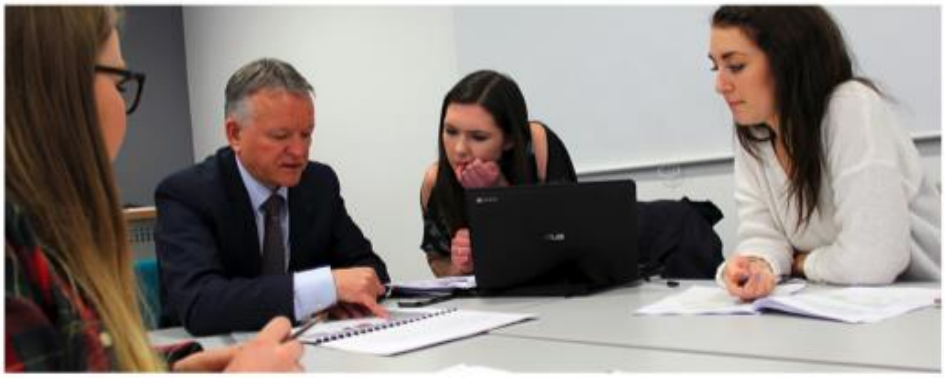
As Mark stated on the day, UoH is "building something quite unique".

Anyone wishing to get in contact with Jo Conlon or Mark Harrop is asked to please reach out to our Editor to arrange this.

Appendix 7 WhichPLM article

Retrieved from https://www.whichplm.com/whichplm-supporting-tomorrows-retail-professionals/

WHICHPLM: SUPPORTING TOMORROW'S RETAIL PROFESSIONALS



WhichPLM's Founder and CEO, Mark Harrop, visited the University of Huddersfield on the 2nd & 6th of March 2015 as part of their retail PLM event week. This article discusses this PLM week for our loyal readers.

Part 1. March 2nd 2015

The University of Huddersfield held a 'PLM event week' earlier in March. This week was the culmination of an educational PLM project, organised by Jo Conlon, Senior Lecturer in Fashion & Textiles at the University. WhichPLM was invited to attend and present on two occasions: 2nd March and 6th March.

2nd March began with two powerful presentations from WhichPLM's Mark Harrop; the first on the "Challenges & Benefits" of implementing a successful PLM solution, and the second, an engaging presentation entitled "The PLM Galaxy". The latter presentation consisted a 360° view of what WhichPLM terms the core processes (of which there are over 50) typically found within a modern PLM solution, delving into the challenges and benefits of each of these processes, including what we term the 'sub-processes' within.

The presentation also examined the many E-PLM (Extended-PLM) solutions that are, today, found within a retailer, brand or manufacturer. I am pleased to state that, from the countless positive reactions, the students were obviously

Each team presented their collection(s) and how they had arrived at them, including: the competition brief, supporting investigations and statistics, competitive analysis, market trends and their own in-store investigations. They went on to explain the key findings and features that led them to design and develop their particular collection(s), and their own experiences with using PLM to support the project. This included the challenges they came across when using the process functionalities.

Following this a panel of judges (including Mark Harrop; Jo Conlon; Mark Lyness, UK Regional Manager, PTC and Nicola Tarratt, Business Change Manager, George Clothing) scored each presentation; they gave constructive feedback to each team on the level of material they presented, and the delivery and execution of their pitch. The competition ended, as competitions do, with the highest scorers being declared winners! This team was made up of final years: Hayley Doherty, Zoe Robinson, Sara Louise Bowring, and second years: Ashleigh King and Jaime Sandelands.

It was extremely rewarding for us to see the students take on-board the points that Mark had made during the previous visit, and to deliver some very high quality presentations as a result. Retailers and brands should take note: the new generation of industry professionals will expect businesses to lead by example. Businesses must possess the solutions required to make a difference and drive value if they are to tempt and keep the finest individuals as employees.

Before this day came to a close, there was the matter of certification. Over the last six months the students have undertaken the WhichPLM Academy courses at Bronze level. We, along with the university, were delighted to confirm that all students exceeded expectations and passed their examinations – with some individuals scoring maximum points. Stella Robson, Kelly Brown, Jaime

enthused with the contents and delivery. These students are all enrolled on the Buying Management BA (Hons) course at Huddersfield and are getting ready to step into the industry. But, unlike other students on similar courses throughout the nation, will be better armed with in-depth knowledge of PLM, including commonplace pitfalls as well as the path to a successful implementation.

WhichPLM was originally invited (some months ago) into Huddersfield University to help students develop their knowledge and understanding of the opportunities, challenges and benefits of a modern-day PLM solution. Since forming the WhichPLM brand in 2007 education has been the overriding goal of our business and we continue to walk the walk when it comes to supporting the next generation of retail professionals.

Part 2, March 6th 2015

Mark was invited back into the University of Huddersfield for 'competition day', held on 6th March. The students had been split into seven groups, each containing three to four members, of both 2nd and 3rd (final) year students.

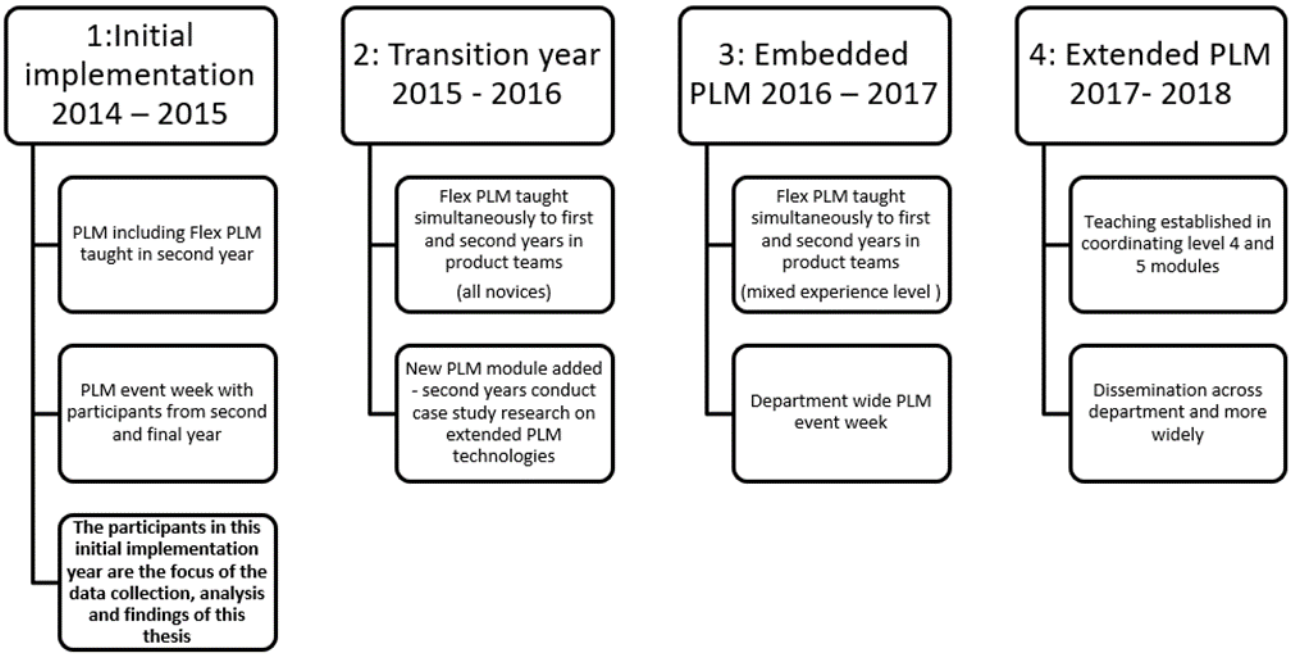
Each group was tasked with designing and building a range of garments for the George brand (the clothing brand sold at UK Asda stores – Asda being part of the Wal-Mart Group). The garments were to be developed within a PLM solution, beginning at concept and ending with the consumer. This course of action included: trend analysis, themes, mood-boards, storyboards, merchandise planning, technical specification, product costing and accompanying sourcing strategy.

Sandelands and Lois Elliot achieved 100% in at least two out of the four courses taken. To reward the students, each was presented with their individual WhichPLM Academy certificate.

Whilst we were truly impressed by the quality delivered and knowledge obtained by every student, compliments must be given to the university. In particular to Jo Conlon, for developing a PLM program based upon the modern PLM marketplace, which at the same time captures the history of PDM, CPM, PLM & E-PLM. This will provide the students the foundations necessary to go into industry and embrace new technologies like PLM.

We are extremely excited to see a university like Huddersfield leading the way in developing one of the first PLM-specific fashion courses. It bodes very well for the not too distant future.

Appendix 8 PLM implementation programme 2014-2018



Appendix 9 Vignette proforma for 'early adopters'

Below is the draft vignette for you that needs some details and comments from you, please feel free to start again but I thought the prompts would be useful:

[Name] (will be [Name] in final thesis – unless you prefer to choose another name)

[Name] joined the University in xxxx with A-levels in x y and z. Her hometown is…., x miles away, and therefore [Name] moved to Huddersfield to live in the area as a full-time student. She chose the course at the University because….

[Name] achieved x in her foundational year and y in her intermediate year studies. [Name] would describe her second year as… Because… Others might say…

The industrial placement was with xxx. This placement appealed to [Name] because…She particularly benefitted from this work experience as…

[Name]'s feelings about returning to complete the final year were…. because…. However, she …

She would describe her time as a student as… She comments particularly on…

Immediately after graduation, [Name] ….

Then… She describes this as…

Now…

To potential students [Name] would like to say…

[Name] would also like to add…

Appendix 10 Recall activity slides

Appendix 11 Feedback questionnaire - PLM taught sessions

PTC University Class Evaluation

PTC® University

Name: _____ Course Name: _____

E-mail: _____ Course or Class #: _____

Class Start Date: _____ Class Location: _____

Training Materials

		Strongly Agree				Strongly Disagree
		5	4	3	2	1
1.1	The mix of lectures, demonstrations, and exercises is properly balanced.	5	4	3	2	1
1.2	The modules of the course were logically sequenced for my learning.	5	4	3	2	1
1.3	The level of detail in the course materials (slides, training guide, etc.) was appropriate.	5	4	3	2	1
1.4	The difficulty, length, and number of exercises is appropriate.	5	4	3	2	1
1.5	The knowledge checks and post-course assessment assisted my learning.	5	4	3	2	1

1.6 Based on your previous responses, please list suggestions that you may have for improving the course content:

_____

_____

_____

Instructor

		Strongly Agree				Strongly Disagree
		5	4	3	2	1
2.1	The instructor understood my skill level and learning needs, and adjusted accordingly.	5	4	3	2	1
2.2	The instructor used a variety of **methods** (group discussions, storytelling, etc.) and **media** (whiteboard, handouts, etc.).	5	4	3	2	1
2.3	The instructor was knowledgeable about the subject matter and its practical application.	5	4	3	2	1
2.4	The instructor kept me engaged and motivated throughout the training.	5	4	3	2	1
2.5	The instructor genuinely cared about my progress in learning the material.	5	4	3	2	1
2.6	I would recommend this instructor to my colleagues.	5	4	3	2	1

2.7 List two things the instructor did well that enhanced your learning.

_____

_____

2.8 List one thing the instructor could improve upon.

_____

Precision Learning

3.2 The instructor recommended additional training courses (classroom, virtual class, or eLearning) based on my job role. Yes / No

3.2 The instructor explained PTC's eLearning Libraries and showed me how to access the eLearning content for this course in Precision LMS. Yes / No

Classroom

	Strongly Agree				Strongly Disagree
4.1 The classroom provided a comfortable learning environment.	5	4	3	2	1

4.2 The hardware, software, and data files were set up ahead of time and performed properly. Yes / No

4.3 If you answered 'No' to question 4.2, please provide details as to what the problems were.

4.4 Please provide any other comments you may have about the training environment.

Summary

	Extremely Satisfied				Extremely Dissatisfied
5.1 Please rate your overall satisfaction with this course and its delivery.	5	4	3	2	1

5.2 After taking this course, I expect my productivity with the software to increase:	I don't know	> 100%	50% - 100%	30% - 50%	10% - 30%	< 10%

5.3 What did you like best about your training experience?

5.4 What could we have done better?

5.5 I would be interested in taking another PTC training course. Yes / No

5.6 If you answered 'Yes' to question 5.5, what course(s) or topic(s) are you most interested in?

5.7 Would you like a PTC manager to contact you to discuss your class experience? Yes / No

dcd: 08 Mar 2010

Instructor: FAX both sides of form to: +44 01252 453655. Or, scan both sides and email to: PTCU-Evaluations@ptc.com
www.ptc.com/training

Questionnaire –PLM Event Week– March 2015

Introduction

The course team are currently evaluating how to embed PLM into the course. These questions are designed to help the researcher develop an understanding of the value of participating in the cross year group, collaborative PLM event week in order to make improvements.

Data collected will be used for research purposes and comments themes generated may be published

Your individual responses will remain anonymous.

Firstly about you

Please tick (✓) as appropriate

I am a first year student ☐
I am a second year student ☐
I am a final year student ☐

I attended on Monday ☐ I attended on Tuesday ☐
I attended on Wednesday ☐ I attended on Thursday ☐
I attended on Friday ☐

Further comments on the arrangements to work flexibly in your teams over the week: .....

.....

Overall how would you rate the experience of PLM Event Week?

		6	5	4	3	2	1	
A	*Engaging*	☐	☐	☐	☐	☐	☐	*Boring*
B	*Good variety of activities*	☐	☐	☐	☐	☐	☐	*Poor variety of activities*
C	*Excellent information*	☐	☐	☐	☐	☐	☐	*Poor information*
D	*Subject explained well*	☐	☐	☐	☐	☐	☐	*Subject explained poorly*
E	*I enjoyed working with new people*	☐	☐	☐	☐	☐	☐	*I prefer to work only with my year group*
F	*I learnt a lot*	☐	☐	☐	☐	☐	☐	*I learnt nothing*
G	*Good room amenities*	☐	☐	☐	☐	☐	☐	*Poor room amenities*
H	*Good to free up timetabled sessions for the activity.*	☐	☐	☐	☐	☐	☐	*Difficult to attend sessions not in normal timetabled slots.*
I	*Our team worked well together*	☐	☐	☐	☐	☐	☐	*Some group members in our team contributed a great deal more than others*
J	*Our team achieved an effective presentation*	☐	☐	☐	☐	☐	☐	*Our group presentation lacked development*
K	*I found meeting and working with new people on the same course a very positive experience*	☐	☐	☐	☐	☐	☐	*I prefer just to work with people I already know.*

Please turn over!

Appendix 12 PLM Event week brief and questionnaire

PLM Event week – timings / details

Monday 2nd PLM – Keynote Speakers to open the week's event– 11.15am – 1.15pm Buckley Theatre, Researcher Hub

Mark Lyness - PTC will talk on FlexPLM specifically for the RFA sector and more broadly on the opportunity that the 'Internet of Things' might offer:

- Originator of the educational partnership with UoH
- **PTC Windchill FlexPLM** can help address both your industry-specific challenges and your everyday business pressures. It offers the most comprehensive Retail PLM capabilities, proven at over two-thirds of the leading retail and consumer product companies. It provides line planning, specification management, merchandizing and other essential PLM capabilities for managing your company's complete assortment of products. Learn why more global leaders trust their product development to PTC Windchill FlexPLM.
- Participants will be presented with a FlexPLM certificate on Friday
- **Smart, Connected Products in the Internet of Things**
- The phrase "Internet of Things" (IoT) has arisen to describe this growing number of products connected to the Internet and reflects the new opportunities they represent. Yet this phrase is not a very helpful in ––understanding the phenomenon or its implications. The Internet, whether involving people or things, is simply a mechanism for transmitting information. What makes this transformative is not the Internet, but the changing nature of the "things" – the products themselves. It is the novel capabilities of smart, ––connected products and the data they generate that is ushering in a new era of competition.
- **Peter Bilello, CIMdata:** "PTC's IoT strategy and supporting lifecycle management capabilities will enable companies of all types to offer new, innovative products and services and to create true closed-loop lifecycle management."

Mark Harrop – Which PLM - Mark Harrop is the founder and Managing Director of WhichPLM. During a career that has spanned four decades, Mark has worked tirelessly to further the cause of PLM – providing the unbiased, expert advice that has enabled some of the world's best known retailers, brands and manufacturers achieve efficiency savings across their entire supply chain through informed technology investments

- WhichPLM is an independent digital magazine dedicated to product development for the fashion industry. With a signature mix of news, reviews, interviews and opinion, it attracts a readership of the biggest names in retail, footwear and apparel from around the globe.
- Mark will take describe the origins of PLM and the current market and opportunities for PLM in the RFA sector
- Mark has provided free access to the WhichPLM academy for staff and students and will present bronze level awards on Friday

Tuesday 3rd March - HW2/18 9.15 – 2.15 and R1/35 2.15 – 4.15pm (both are PC labs)

Build your range plan and accompanying sourcing strategy; simultaneously upload relevant data into FlexPLM

Wednesday 4th March - HW2/18 9.15 – 4.15

IT Support / Troubleshoot / Resolve any FlexPLM issues with Vivek Mani from ITC Infotech

Thursday 5th March 10.15-2.15pm CS3/04 (library room) 10.15 – 2.15pm

Last chance to IT Support / troubleshoot / resolve any FlexPLM issues with Vivek Mani from ITC Infotech

Thursday 5th March W2/43 Available for presentation practice 3.15-5.15pm - Book a slot via wejoinin: http://www.wejoinin.com/sheets/ndpoo

Friday 6th March 10.15am- 2.15pm W1/63 for presentation to peers / expert panel / George at Asda

Certificates presented and photographs for Press and publicity – George, PTC, WhichPLM and UoH

PLM Event Week 2015

George.

Held range opportunity

The task:

'Held' budget for SS15 is about to be released and therefore your product category team has the opportunity to prepare a range proposal for submission to the senior buying team.

This proposal should be presented on Friday 6th March from 10.15am and must indicate:

- Customer profile
- Justification (including comp shop analysis)
- Trend inspiration
- Colour palette
- Fabric and trim detail
- Sourcing plan
- Proposed size range
- Merchandizing breakdown (including proposed price architecture) and total budget requirement / anticipated profit
    - Range would normally consist of 6-9 products (you may wish to propose additional candidates for each placeholder and should indicate any proposed colour options clearly)
    - Minimum buy / way would be 5000 units
- As commitment to proceed into production will be given at the meeting your presentation must be accompanied by supporting Tech Packs for all proposed products
- Presentations should be15 minutes long and will be followed by a Q&A session

PTC® whichPLM™ dedicated to the fashion industry ITC INFOTECH Business-friendly Solutions

Questionnaire –PLM Event Week– March 2015

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Firstly about you

Please tick (✓) as appropriate

I am a first year student ☐
I am a second year student ☐
I am a final year student ☐

I attended on Monday ☐ I attended on Tuesday ☐
I attended on Wednesday ☐ I attended on Thursday ☐
I attended on Friday ☐

Further comments on the arrangements to work flexibly in your teams over the week: .....

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K	*I found meeting and working with new people on the same course a very positive experience*	☐	☐	☐	☐	☐	☐	*I prefer just to work with people I already know.*

Please turn over!

Training Materials- Comment here on aspects relating to learning about PLM and FlexPLM:

1. In-class group task to evaluate PLM software companies

   .....

   .....

2. WhichPLM online course

   .....

   .....

3. Training sessions on FlexPLM
   a. Orientation

      .....

      .....

   b. Sizing

      .....

      .....

   c. Line Planning

      .....

      .....

4. Lecture notes for these sessions

   .....

   .....

5. PTC University – online training

   .....

   .....

6. Event week guide

   .....

   .....

7. Tutor(s) support

   .....

   .....

The Task: Missed Opportunity Range for George- Comment here on aspects relating to the task itself:

1. Authenticity of the task:

   .....

   .....

a. List three words to describe the task:

.....

.....

2. Product category of own choosing

.....

.....

3. Opportunity to meet team through pre-arrangements

.....

.....

4. Pre-training

.....

.....

Reflection on the experience

1. List three things that went well:

.....

.....

2. List three things you would do differently next time:

.....

.....

3. How does this relate to your studies?

.....

.....

4. How does this relate to your career ambitions?

.....

.....

5. Anything else?

.....

.....

Tell us how we could improve this event, particularly if you gave low scores above:

.....

.....

.....

Please return to Jo Conlon at the end of the session

Thank you for participating in the workshop and completing this questionnaire

Appendix 13 Summary of data collected

Date	Session	Cohort	Video *	Time	Total time		Words	
17th February	Taught session 1a / b	Year 2 students	8	27.53	Video - 162 mins	Transcript	1188	Survey
			9	37.36			741	
			10	5.51			90	
			12	21.85			2359	
			13	11.9			627	
			14	37.1			3097	
			15	21.1			3497	
22nd February	Taught session 2	Year 2 students	17	37.4	Video - 146 mins	Transcript	924	Survey
			18	18.7			327	
			20	37.4			203	
			21	29.3			247	
			22	23.38			238	
24th February	Taught session 3	Year 2 students	24	37.31	Video - 100 mins	Transcript	1085	Survey
		(multiple conversations)	25	37.11				
		(multiple conversations)	26	25.8				
26th February	Taught session 4	In product teams	27	37.31	Video - 100 mins			
		(multiple conversations)	28	37.18				
		(multiple conversations)	29	25.8				
6th March	Student presentations	In product teams x5	30 - 34	109	Video - 109 mins			
6th March	Post-event Q&A	In product teams	36	37.32	Video - 60 mins	Transcript	2849	Survey
			37	22.34			1562	
10th March	Y2 debrief	Year 2 students	38	33.22	Video 33 mins	Transcript	603	
July 2015	Interviews	Final Year Interviews x3	-	-	-	Transcript	6548	
June 2017	Recall event	Year 2 students (of 2015)				Transcript	9840	
	Vignettes	Early Adopters				Transcript	3267	
				11 hours 50mins			39292	

* numbers missing from the sequence indicate setting up or breaks where no data was collected or video recording of external speakers during event week

Appendix 14 Evaluation template: RUFDATA

Name of initiative:

Embedding PLM into FTBM

Reasons and Purposes What do you see as the main reasons and purposes for this initiative?			
Uses What specific outcomes do you see as the benefits from this change?			
Foci What priority areas should be identified?			
Data and Evidence How should we evaluate?			

Audience Who should be consulted? Who should be informed?			
Timing How frequently should progress updates be?			
Agency Who should be involved in the evaluation?			

Adapted from: Saunders, M (2000) Beginning an Evaluation with RUFDATA: Theorizing a Practical Approach to Evaluation Planning. *Journal of Evaluation, Vol 6 (1): 7-21*

Appendix 15 PLM case study book chapter

How PLM drives innovation in the curriculum and pedagogy of Fashion Business Education: A case study of a UK undergraduate programme

Abstract

PLM is increasingly understood as a strategic platform to facilitate business transformation through its dual role: firstly, driving operational excellence and then as a platform for innovation through providing an impetus for continuous engagement with emerging technologies. The three P's of PLM: process, product data and people, remind us that if the transformational potential of PLM is to be achieved, there is a growing need for professionals with an understanding of PLM as the backbone of the future enterprise facilitating an open-ended view of product lifecycle management. The retail sector, previously a late adopter of PLM, is now undergoing a period of significant investment. In parallel, educators within the associated higher education sector are challenged with maintaining a forward-facing curriculum and providing new learning environments that engage students to suitably prepare them for future professional practice. The argument that is advanced in this case study is that PLM provides a contemporary framework and alternative approach for establishing a collaborative, forward-facing pedagogy for fashion business. Further, the insight and energy of students and graduates at the periphery of practice or their 'peripheral wisdom' (Wenger, 1998, p.216) has much to contribute to a sector in transition. This case-study reports on the first ever educational partnership to embed PLM in an undergraduate fashion programme in a UK University and seeks to encourage other educators to embrace PLM as a vehicle for educational change. This partnership was formed in 2014 with PTC for FlexPLM. The case study illustrates the initial implementation of product life-cycle management in conjunction with a shift from traditional lectures to collaborative learning practices to provide a powerful learning environment that equips future fashion professionals with a key differentiator that can drive the transformation of the industry.

Background

I am an experienced Senior Lecturer in Future Fashion and Textiles Industries with 18 years' technical and management experience in the retail clothing sector. My previous role as Technical and Sourcing Manager within the supply chain of Marks and Spencer involved extensive travel sourcing and developing the supply chain to deliver innovative, quality products. My early career was grounded in a systems approach to product development and

global supply many years before this approach became best practice. The benefits of PLM in driving supply chain excellence and ensuring compliance resonated with my background and became the focus of my research. I will complete a Doctorate in Education (EdD) in December 2018; my research centres on how a Product Lifecycle Management (PLM) approach can reshape fashion business education; I have established the first ever educational partnership for fashion PLM. The learning experience extends beyond the core benefits of PLM, we aspire for our students to become change agents in the industry and help businesses realise exciting new opportunities in a more democratic and sustainable industry through enhanced customer experience and engagement with the value chain.

The Business of Fashion

'Study of the fashion system is a hybrid subject. Loosely defined as the interrelationship between highly fragmented forms of production and equally diverse and often volatile patterns of demand, the subject incorporates the dual concepts of fashion: as a cultural phenomenon and as an aspect of manufacturing with the accent on production technology.' (Fine, Fine and Leopold, 1993, p. 93)

As the opening quotation explains, the business of fashion is a complex one and therefore learning to become a proficient professional within the industry is multifaceted. Fashion has significant cultural significance and economic weight as an industry. The textile and clothing sector is among the largest industries in the world; it contributes significantly to the economy of many countries, with a total end market worth over Euro 2 trillion on a global level (Walter, 2016). The global fashion business is a large and diverse sector that comprises traditional manufacturing as well as the creative activities typical of the creative economy (Aspers and Skov 2006, p.802). This fact: that the fashion business includes both the creative sector and traditional manufacturing industries sets up the inherent tension or paradox of the sector (Clark, 2015, p.5) - with *fashion* open and responsive to consumer trends and thereby inherently dynamic and uncertain contrasting sharply with structured *business* procedures established to generate a specific financial result. Fashion business professionals have to balance commercial success (meeting consumer needs) with financial performance (Clark, 2015, p.8).

The Seismic Shift in Retail Fashion

In the past the supply chain strategy of the apparel industry has been categorized as more of a push model as illustrated in fig.1 depicting the standard fashion design and production process referred to as 'the buying cycle'. Competitiveness was previously based on

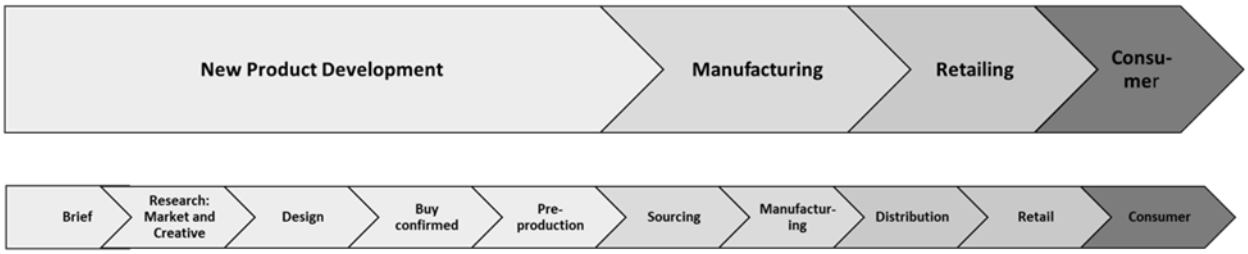

Figure 1: The Standard Fashion Design and Production Process (adapted from d'Avolio, Bandinelli and Rinaldi, 2015; Han, Tyler and Apeagyei, 2015).

achieving high volumes at low cost, however cost control and efficiency have now become standard. Today's success is determined by the ability to be flexible and responsive (Christopher, Lowson and Peck, 2004) or the pull-model synonymous the ability to be responsive to consumer demand through product and process innovation based on a deep understanding of customers coupled with robust supply chain relationships throughout the extended enterprise. The shift from push to pull production represents a seismic shift in retail management (OC&C Insight, 2016, p. 2) prompting a fundamental rethink of processes and practices that has been described as changing retailing from 'transmit to receive' mode (Jong, 2017, p.1). Digital technologies are pivotal in enabling the shift as elegantly summarized by Crewe (2013, p. 761):

'The emergent computer – consumer – commodity nexus is thus of fundamental importance in that it holds the potential to reshape our understandings of organisations, consumers and the mechanisms through which fashion knowledge is generated and circulated.'

Fashion Business in Higher Education

From the 1980s, degree programmes in 'managerial fashion' (McRobbie, 1998, p.46) began to emerge alongside the more established and recognised fashion design degree programmes. This represented a new realism in fashion education and reflected the shift to global sourcing and growing importance of mainstream retail fashion. Within these fashion management programmes, most students conceive their education as vital to help them achieve their aspirations to work within a retail brand. One of the central positions within fashion retail brands is the buyer whose role is to ensure that the right products arrive in store at the right time and price from an analysis of consumer trends, current events, and previous sales with an in-depth understanding of consumer needs. The buying team

translate this information into a product range that is negotiated with suppliers in terms of cost and delivery, supported by technical and sourcing specialists. Once the product is in store, product sales must be monitored closely in order to react to changes in demand. Industry demands graduates that can 'hit the ground running', however, as educators, our job is to prepare students for the future not just train them for today.

Within higher education there is an ongoing shift away from passive learning through traditional lectures and a growing interest in integrating learning with experience in practice settings. Now, fashion institutions around the world seek to prepare graduates to succeed academically and be proficient in the ability to connect both ends of the value chain, i.e. production and consumption and balance commercial and financial performance (Aspers and Skov, 2006, p. 802). Central to this challenge, in an increasingly digital age, is learning how to manage the tension between creativity and commerciality. Further, increasingly researchers argue that education must reflect emerging global socio-political trends not just respond to commercial and economic demands from business. Current educational research asserts

that it is important to preserve 'artistic freedom' within higher education as the source of critical, creative and innovative thinking to enable graduates to become change agents and manage demands for global citizenship (LeHew and Meyer, 2005; Karpova, Jacobs, Lee and Andrew, 2011), sustainability (Pasricha and Kadolph, (2009); Radclyffe-Thomas, Varley and Roncha,2018) and embrace technology (Muhammad and Ha-Brookshire, 2011; Romeo and Lee, 2013).

The pressures and complexities of our industry and working with a growing volume of information can be overwhelming for many learners, teachers and institutions alike. Therefore, it seemed appropriate to seek a digital learning environment to support and prepare students for roles in this complex, fast-paced and challenging creative environment. With the PLM acronym playing a 'holistic' role (Stark, 2015), the PLM framework can be utilised as a conceptual map and a mechanism to demonstrate the integration of diverse business activities throughout the product lifecycle as illustrated in figure 2. PLM provides a framework that permeates all aspects of the body of knowledge and provides a holistic view of industry processes, an up-to-date context for study that facilitates the opportunity to critique traditional practices and thereby generate new practices.

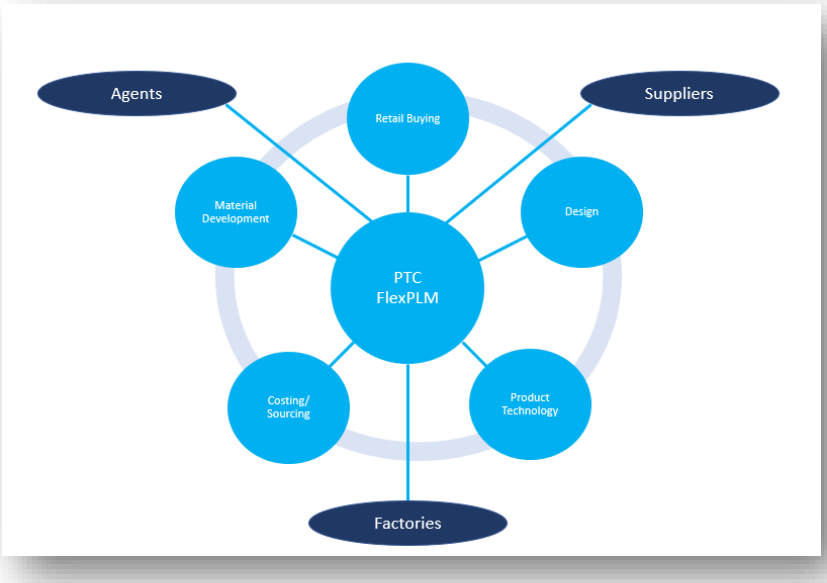

Figure 2: FlexPLM as a central hub of function and process integration underpinning the educational programme (image courtesy of PTC)

The ambition behind the change initiative

In 2011, with the increasing levels of investment in fashion-specific PLM solutions by retailers and brands it became evident that our future graduates' working environment would be within a PLM system and therefore we concluded that PLM should be included in our educational programme. We were keen to introduce PLM education at all levels in the programme to ensure that our graduates enter employment with a baseline of PLM knowledge, able to recognise the benefits it can generate, the problems it can solve and future opportunities it can stimulate. Our ambition for the BA Fashion Buying Management programme was to create a forward-facing curriculum that contributed positively to the sustainability and democratization of the apparel sector. What was sought through the proposed intervention was the development of a mind-set capable of utilizing technological innovations to critique existing processes and practices and create alternatives that respond to the demands and opportunities of new times, new needs and changes in circumstances.

An issue for the implementation of PLM into education is that there is no equivalent to the ROI calculations to support a business case for the investment. This is exasperated further by a conservative attitude towards software investment due to concerns over staff technical skills, packed curriculums and other educational priorities. It was only through the generous offer from PTC of an educational partnership where the first-year costs were waived that

this intervention to integrate PLM into an undergraduate degree programme was made possible. This period allowed for a strong business case to secure budgetary support for subsequent years to be built from information relating to the scale of industry investments coupled with positive internal reports in terms of student engagement, recruitment potential, opportunities for wider research and funding opportunities.

Starting our PLM journey

This intervention builds on several previous failed attempts to secure funding for PLM software. Due to these funding constraints, before we had a live system, we used PLM to frame teaching and used open source software to establish a collaborative team space (Conlon and Taylor, 2012). Within the second-year programme there are three core modules; PLM was integrated into the global sourcing module. The PLM framework was utilised to clarify the processes involved and illustrate industry best practice. All second-year textile students (management and design students, n=95) worked collaboratively in product development teams mimicking the processes and practices of industry. This shift to learning through practice, represents a pedagogy more closely aligned to the approach to teaching and learning in design (Tovey, 2015; Orr and Shreeve, 2018) and was an important precursor stage as it allowed for collaborative team-based learning to become established.

As PLM becomes the backbone of the modern industry, we recognised the importance of our students working **hands-on** within a PLM solution recognising the importance of an experiential and practical understanding of PLM. A combination of our previous interest, geography and good luck resulted in the educational partnership for PTCs FlexPLM system. Given the lack of PLM knowledge in the sector and that many core processes and practices within the standard fashion process model were developed before today's advanced technology there is a clear opportunity for our graduates to differentiate themselves in competitive job markets and make a positive contribution to the sector using the knowledge gained through their participation in this intervention. The significance of this statement to retail brands was highlighted by Suleski and Draper (2014):

'as adoption of PLM becomes mainstream in the industry, having the required talented employees in a business to challenge and overhaul legacy practices is a prerequisite to achieving the potential that the technology offers.'

The Initial Implementation

We went for a phased implementation of FlexPLM, adding the creation of a 'tech pack' within PLM to the earlier redesign. A tech pack is the industry short-hand for a set of documents that a manufacturer needs to turn the design into a product. A tech pack represents a convenient and recognised milestone that aligns well with my previous experience of sourcing and supply chain management and reflects the growing interest in supply chain transparency. As before, it was planned that the students would work in product development teams to develop a range with the addition of a 'tech pack' generated in PLM for each product proposed.

At the time, several final years returned from their industrial placements keen to know more about business improvements and the role of PLM. There was clearly an opportunity for a second years and final years to work together to share their experiences. Therefore, in addition to the year two teaching and learning programme, we utilised the mid-term reading week (i.e. no timetabled sessions) to organise a week-long PLM collaborative event where second and final year students would work in product category teams. Responding to a live brief from George at Asda, the students developed and presented an open-to-buy (OTB) range with a supporting tech pack for each product. In reality, a tech pack can be produced without a PLM system and therefore the authenticity of the task to work practice was generated by the live team brief and limited development time. The week's event culminated in a final presentation of the proposed ranges to a panel from industry and the university. This provided a valuable opportunity to 'perform like' industry professionals and receive positive feedback and additional comments. The panel agreed the students had clearly demonstrated their competence as illustrated by these two exemplar comments from the panel member from George at Asda:

'I really like the level of detail you've gone into on your competitor analysis. I love the fact you mentioned: good-better-best which is something that we would benchmark against. I like the fact you thought to look to our website to find approved factories. I like the fact that you indicated that you have considered more than you have put forward for selection. That is something that we always do - this gives some flexibility to mixing and matching. I also like the fact that you had considered different size ratios for different products although this would always be open to challenge. It's good that you had considered what she would wear, although these are difficult conversations and decisions.'

'…previously my background was senior merchandise manager for George , so I would have signed off that money on the garments that you've presented here, I'd have spent that cash with some extra information on the costing - I don't expect you to have done that level of

detail here - I would have signed off on that and I think your comp shop work is easily comparable to what we would see back in the office, so thank you for that.'

It might be imagined that the lack of live data in the educational setting presents a significant barrier to implementation of PLM. However, adding items to the library can be incorporated into the learning with notable benefits. The opportunity to apply knowledge in practice helps to develop an in-depth understanding of the black box of current processes and practices. Further, the richness of learning the 'longhand' process yields a better appreciation of the automation of administrative tasks that PLM delivers. The task of working in collaborative product category teams to generate a bill of materials (BOM) and 'tech pack' reveals the complexities and interconnectedness of product development and the strategic challenges for organizations better appreciated. The associated assessment task documents these processes and critically discusses the management of the relationship between new product development, supply chain management, retailing and the consumer in relation to industry practice in an illustrated report of 5000 words. The experiential learning has clearly overcome initial resistance and contributed to a rich understanding 0f the role strategic management role of PLM:

'I was so sceptical of the whole PLM thing towards the start - I thought I don't want to learn this: it looks rubbish! And then I did it and I really, really enjoyed it! [The main part] for me was learning about PLM because I didn't know anything about it and thought it had nothing to do with what I want to do… But now I understand why retailers would use it for management.' (Student feedback)

After the PLM event week, the students returned the final stage in the formal taught programme (fig 3), which focuses on using PLM as a platform or backbone for other technologies and included guest lectures, case studies, interviews. The second assessment was an individual case study assessment (5000 words), where students undertook primary research to understand current practice and research into innovative, strategic and applied opportunities for extended PLM technologies and proposed business improvements in diverse topics including 3D visualization for prototypes, AR / VR in retail, sustainability, big data and IoT. Exposure to PLM has provided students with the impetus to solve problems and challenge legacy practices through their ongoing research. This further research is clearly underpinned by the provision of opportunities for students to develop and test their ideas and skills and gain industry insight; we would like to acknowledge the generosity of Mark Harrop, the WhichPLM team and the WhichPLM academy website particularly.

Figure 3: Three main stages in the integration of PLM into the second-year module of the BA programme

Students are able to see that PLM will likely feature in the future workplace; one student saw the value of this intervention as a safe environment to experiment and learn before entering employment:

'In the actual business environment, the likelihood is, that by the time they come to graduate, the company that you do go to work for is going to have PLM. So rather than waiting till you're in the business, where the job that you're doing on the system actually has impact - you could mess up a SKU [stock keeping unit or product line], that's the reality of it – why would you not want to trial that in in the University where it is not actually affecting real products? It's not actually affecting deadlines, the product arriving and stuff. It is a key industry tool that you are going to be so aware of when you graduate and go into the industry, why wouldn't you want to trial it before you actually could potentially (laughing) mess something up on it?' (Student interview comment)

The benefits achieved

There are many positive outcomes from this first phase. I came to be an advocate of PLM from a supply chain background, and uphold that there are many benefits in a greater connection and understanding of manufacturing. The PLM learning environment has helped bring the curriculum to life, made it more relevant to students' interests and demonstrated the need to work collaboratively to achieve the best results. It has also revealed a more diverse range of career opportunities to students. However, it is in its power to encourage innovation that I see as its core value to the industry. The students' have an enthusiasm for

the potential of technology and an eagerness to contribute to industry. They see technology as an enabler and are keen to experiment with new possibilities - for them, everything is possible, there's an app for everything, or certainly should be! One student expressed that she felt she has much to offer from her knowledge and experience and sees it as a position of strength for the future as implementation becomes more widespread:

'So, having that from an educational background as well, actually having dealt with in a classroom, is really good. I feel that companies aren't going to know what's hit them when us graduates come and join. We know all this stuff; I think it's really good. **I think this is where the change probably has to come from**. Some people, like when I was at [placement company], literally no one had even heard of it. Some people had been working there for 30 years or something, businesses like that who are doing good business, they are so ingrained in their old ways of working, it's like 'if it's not broken don't fix it' so it needs to come from somewhere. The fact that we are being educated to know this is really great.…especially because of all these high-calibre implementations that are happening more recently, I think it will filter through.'

Next steps foreseen

The initial intervention was in the 2014-15 academic year. This format has repeated with minor iterations; PLM is now an integral part of the teaching programme with some students taking this topic further in subsequent research and careers. The next phase will include costings and workflow management to give a richer experience of PLM. The openness of the structure (figure 3) allows for flexibility to respond to emerging themes in the industry and reflect students' interests. The intervention remains at course level despite efforts to disseminate further. In 2017, a similar event to disseminate PLM across the whole department of Fashion and Textiles was planned but this was not well-supported and did not go ahead. Promoting such optional events requires a significant investment in time to coordinate wider support and perhaps we had underestimated the reticence of design students to engage with business practice. However, learning from this, in 2018 we successfully hosted a digital story boarding event open to all students in the department as an introduction to PLM and digital asset management.

This intervention mirrors the current industry focus of PLM around new product development. We seek to build a life-cycle perspective beyond ideation, design and manufacturing (beginning of life or BOL), to consider use (middle of life or MOL) and disposal (recycle) at the end of life (EOL) by demonstrating the potential of PLM to close the

information loops in a shift to more circular economy business model (Weetman, 2017, p.278).

Taking this into consideration, it may prove more productive to engage with fashion management programmes externally such that students then benefit from academics sharing their expertise. Collaborations with interested parties with expertise to contribute, for example in sustainability, merchandising, data analysis and virtual prototyping would be welcomed. Collaborating internationally would also help students gain an insight working digitally across different cultures and time zones.

The lessons learned

- This project has strived to foreground a forward-facing educational perspective that recognises the limits of 'know-what' knowledge and the potential of learning through practice to broaden knowledge to also include know-how, know-why and know-who (Lundvall, 2016, p.136). Time and energy are needed for the shift away from the lecture and other forms of traditional higher education practice to a level of acceptance and proficiency in collaborative team-based learning through live briefs. From our experience, we believe a commitment to student autonomy and an openness in assessment tasks is required to promote active student engagement in their own learning. The opportunity to learn with students from the same course, but at different levels can be a powerful motivator:

'It kind of puts in your head, that you will get to that stage - that didn't just happen, that didn't come out of thin air. They got there from doing the whole course…It made me feel like she's not just come on the course and known everything, she's actually learnt that. It gives you the initiative to push on, you can be at that stage. It pushes you to carry on…' (Second year student)

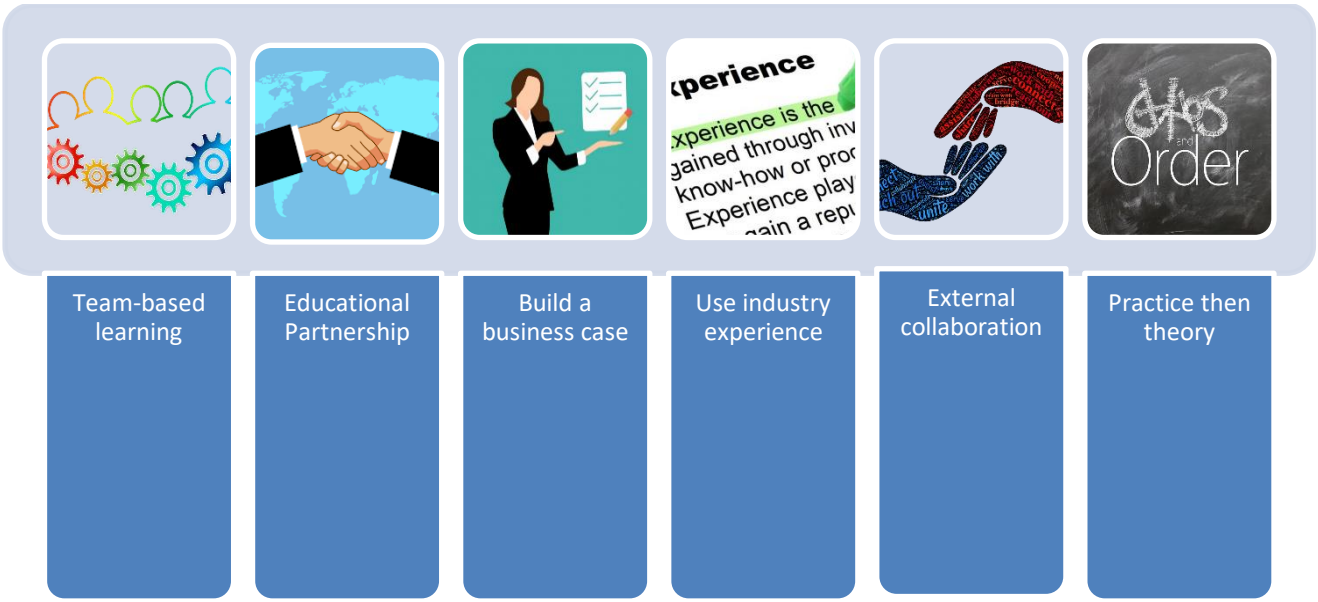

Figure 4: Summary of the main lessons learned

- As stated earlier, the educational partnership was fundamental to it getting this project started. It helped to build a level of commitment and understanding on both sides. PLM is now at the heart of an evolving digital ecosystem and therefore the partnership provides valuable industry insight on how current practice is unfolding. As research practice develops, a balanced two-way communication can be established in the contributions of the partners.
- It is important to recognise that ongoing funding will be needed to sustain the new programme. The reality is that in order to secure ongoing budgetary support, projects need to provide a business case which can be strengthened by communicating associated successes in recruitment activities, student satisfaction and the opportunities for funded research.
- The industrial experience of the academic team should be considered to help to establish a useful entry point for PLM implementation into the curriculum. This experience should be brought to the project as a valuable resource for the students to access. This can help to counter concerns that relate to a lack of expertise in the technical aspects of the software. Although staff training will be provided, it is important to recognise this will only provide competence rather than expertise and therefore staff will need to join the PLM learning community as equal participants in a new digital environment and not to attempt to achieve any sense of academic 'expertise' regarding the software.

- A closer collaboration between industry and academia is imperative if the transformational potential of PLM is to be realised. This project accessed significant external support for guest lectures and seeks to establish a two-way traffic of ideas. To facilitate this, there needs to be a greater receptiveness to this interaction in the members of the industrial community, recognising the possibility to gain something of value from the students' alternative perspective and give them the chance to invest their energy, contrary to the experience of a final year during graduate position interviews:

'I feel that going in as a trainee, I know that for the older buyers and merchandisers, it wasn't around when they were at university, I think that perhaps they might not value it is as much. I know that's not what I should say but that's how I feel that I will be bypassed and not taken seriously…Even when I did mention it [PLM] in my interview, the Merch just looked blank, and didn't seem to follow the conversation, [because] the knowledge doesn't seem to be there.'

- Finally, our experience has led us to be strong advocates of practice-informed learning and we would recommend that practice precedes academic theory i.e. experience at the local (contextual) level precedes that at the broader (conceptual) level.

Advice - the do's and don'ts

As in industry, the appointment of a project lead is recommended. This person needs to commit to gaining a strategic understanding of PLM and accept the open-ended nature of the task. Case studies, the blogs and websites of thought-leaders provide valuable information and insight that can be adapted according to the discipline and educational settings to support a successful implementation. The next stage involves establishing a project team to develop and share a clear picture of 'as-is' and 'to-be'. It is recommended that this is cross-functional team and includes other academics, students and IT and reports regularly to a member of the senior management team. It is important to emphasise the significance of including IT. Sadly, universities are prime cyber-attack targets and firewalls are in place to provide security, therefore IT need to be involved to manage an open experience within PLM. At the time of this implementation (2014) cloud and app versions of retail PLM were not as prevalent as they are today. Accordingly, this project installed PLM to servers held on site. The evolution to hosted (cloud) systems with an open additive 'platform' approach to system architecture seems to offer many benefits in terms of security and also for modular adoption. The project team needs to understand the typical time

period of PLM implementations but it is advised that external partners are made aware of the glacial speed of change in higher education due to bureaucratic and extended quality procedures. It is also important to not let this inertia prevent further development and to use ongoing attempts to scale the intervention to provide a fresh impetus to continue. Finally, many forward-thinking organizations are establishing a millennial shadow board as a source of innovative thought (Bain, 2017), therefore employ the energy of the students, those who have the most at stake in the development of future practice, as a powerful source of energy and inspiration.

Conclusion

This paper is the first to report on PTC's FlexPLM being embedded into an undergraduate fashion programme and can provide valuable pointers for how educational partnerships can develop both pedagogy and curriculum content. Through this type of partnership, the curriculum content can be developed to enable graduates to develop capabilities in closer alignment with the current and future needs of industry. This study used Product Lifecycle Management (PLM) as a vehicle for change to develop a new creative collaborative, participatory and holistic model of learning and teaching of fashion management in order to better prepare graduates to tackle the issues and challenges of industry in the 21st-century.

Appendix 16 Research Participant Information Sheet

Section 4: FORM 3

University of Huddersfield
Art, Design and Architecture
Ethical Review Procedure
For Research and Teaching and Learning

Research Participant Information Sheet

You are invited to take part in a staff research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others or a university representative if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

Name of Researcher:

Jo Conlon, Senior Lecturer, ADA, Queensgate, University of Huddersfield

Title of the Project Research:

An investigation into the potential of curriculum innovation and transformation using product life-cycle management (PLM) in higher education

What is the aim of the project/research?

To demonstrate, via an illustrative case study, how a PLM structured learning environment and critical engagement with the PLM philosophy might be embedded in an undergraduate programme stimulating new practices and setting the context for broader change.

Why have I been chosen?

The teaching of the PLM software will be predominantly in the second year of Fashion and Textile Buying. You have therefore been selected as part of this cohort.

What would I be asked to do if I took part?

The teaching sessions will be videoed and analysed but no individuals will be identified in this process. You will additionally be asked to give your feedback on the learning experience throughout the teaching. You are also being asked to consent to your final assessed piece (PLM case study) being reviewed as part of the research. There will also be the opportunity to volunteer specifically to some additional sessions.

What happens to the data collected?

The data will be transcribed and analysed thematically using Nvivo coding

How is confidentiality maintained?

No names will be recorded in the data collection process in order to maintain anonymity. All data will be stored securely and password protected.

What happens if I do not want to take part or if I change my mind?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time without giving a reason and without detriment to yourself

Will I be paid for participating in the research?

There is no payment or other advantage for participation; equally there is no disadvantage if you chose not to participate.

What is the duration of the research?

Phase I of the research project runs Feb – May 2015. In this time the teaching sessions relating to FlexPLM training will be recorded.

Where will the research be conducted?

Queensgate Campus, University of Huddersfield

Will the outcomes of the research be published?

The completed doctoral theses will be available through the University repository. It is planned that journal papers will be extracted from the theses for dissemination.

Contact for further information:

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Appendix 17 WhichPLM article

Retrieved from https://www.whichplm.com/empowerment-employability-a-students-perspective/

EMPOWERMENT & EMPLOYABILITY: A STUDENT'S PERSPECTIVE ON PLM

WhichPLM has already reported on the time our CEO, Mark Harrop, spent educating students at two of the UKs top universities. Here, we let the students have their say; Ashleigh King from Huddersfield reports.

Over the past several months, WhichPLM has dedicated considerable time to educating students, like myself, on the Fashion and Textiles Buying Management course at the University of Huddersfield.

Students enrolled on the course began their studies with WhichPLM some months ago now. As one of them, I was lucky enough to partake in the guest course from beginning to end. To start, a lecture was held for the second year students; I went along, knowing very little on PDM or PLM, eager to learn from Mark Harrop, WhichPLM CEO, and Morag Ashworth, WhichPLM Academy lecturer. Suffice to say I learnt a great deal.

We were given a task in which we were asked to research the various vendors of PLM, taking into account the benefits of each in relation to the RFA sector of the market. Mark and Morag were then able to share their expertise on each vendor and the specialties of each solution; they also explained how each supplier creates a unique selling point to their targeted businesses. This gave us a great overview of a wide range of PLM vendors and the competitive landscape of the market; very similar to that of retail fashion chains and how they target their ideal consumer.

Along with some final year students, my fellow second year classmates and I were given the chance to further develop our knowledge of PLM by using the software ourselves, as part of the department's PLM week some time later. This week involved using the knowledge WhichPLM had provided. PTC's FlexPLM

Overall, the depth of information from WhichPLM Academy has offered me (amongst the other students from the University of Huddersfield) a competitive edge when applying for placements and graduate jobs. I am now aware of the up-to-date benefits of PLM within the RFA sector, and the challenges and problems within the industry that PLM can address and overcome. The knowledge gained will help us all face and target everyday problems that may arise within a product's lifecycle, and help us to minimise the risks of these re-occurring with the sourcing of new products.

With companies continuing to implement modern technologies like PLM into their everyday working lives, the students at the University of Huddersfield will have a head start in PLM and how to successfully implement the right solution to suit the needs of each business.

I would love to say a huge thank you to Jo Conlon, Senior Lecturer at the University of Huddersfield, for organising and bringing PLM into the Fashion and Textiles Buying Management curriculum and also to the WhichPLM team for giving the students extensive knowledge of PLM and the chance to take part in the WhichPLM Academy Bronze modules, as well as for the guidance they have offered us (the 2nd year Fashion and Textiles Buying Management students) to help towards our recent PLM case study project for University.

The team at WhichPLM has passed on some of their extensive knowledge into the differences between a Product Data Management (PDM) system and that of

solution, and the George clothing brand. Using the knowledge acquired from Mark and the WhichPLM Academy Bronze module (which we had all undertaken some weeks prior), we used FlexPLM to create a range proposal for George, and present this to the brand's Senior Buying team.

During this week, presentations were also given from elite PLM professionals like Mark Harrop, who gave us extra guidance to complete our tasks. WhichPLM highlighted the importance of new project issues and challenges along with essential tips for planning a successful implementation of PLM, all the while answering the challenging questions and queries we had regarding the brief for the task.

I now know that I can take the knowledge I have gathered and develop this in order to advance my career – knowledge which I would never have gained without the help from both WhichPLM and PTC.

a modern PLM system. Beyond this, Mark Harrop has left students with knowledge of some key features involved in the successful collaboration of Enterprise Resource Planning (ERP) to modern-day PLM implementations within fashion retail businesses.

I, for one, feel empowered to enter the industry knowing what PLM really is, and what it means to today's retailers and brands. I'm certain that this knowledge will aid my fellow Huddersfield peers and myself when it comes to future employment opportunities.

Appendix 18 WhichPLM article

Retrieved from https://www.whichplm.com/empowerment-employability-a-students-perspective/

Working with PLM; a student's journey

Jonathan Cameron is a student at Huddersfield University here in the UK, currently in his second year on the Fashion Buying & Textile Management course. WhichPLM has reported on some of our previous visits to UoH over the last few years. Having read WhichPLM's perspective on these visits, now, our readers are able to find out more from first-hand experience. Jonathan shares his perspective on the challenges around learning about new technologies, and his expectations on entering the industry.

As students it is expected that we will be introduced to new concepts and ideas throughout our education. And as a second year student at Huddersfield University, studying Fashion Buying and Textile Management, I am no different.

This year I have been introduced to PLM for the very first time.

PLM is a wide reaching concept – so wide, in fact, that trying to understand it in its entirety has proved very difficult. This being said, with the support of Huddersfield University and Mark Harrop, WhichPLM's CEO, along with my peers I have been able to make those pivotal first steps into understanding one of the most significant developments facing the fashion industry.

Mark has been a guest lecturer at Huddersfield for some years, and has been generous enough to provide my class with some competitive insight into the numerous software providers out there; he has lectured us on the current state and potential developments of 3D working, and also aided us with our final PLM case studies by sharing his knowledge and experience for our primary research.

First-hand experience

One of the most valuable experiences granted to us this year was the opportunity to be able to work with a PLM system for ourselves. This was a joint project with the first year students on my course. The project involved coming up with a collection for a specific retailer that currently uses PLM; we were asked to input information into a PLM database for the collection (colour ways, fit measurements, fabric compositions ect.) and collate all of the information into a usable tech pack.

By taking part in this project, it is easy to see the vast benefits that PLM has to offer us, as future industry professionals. It has become clear that PLM software can help range planning, and the compiling of a tech pack can be much more efficient and collaborative. The collaborative benefits are boundless, as information is much more easily shared – once the data has been inputted, anyone able to access that data can see updated information in real time which, in theory, should help quicken and streamline the communication cycle between key players across the buying chain.

This, of course, is only one of the ways in which PLM can help to influence and improve practices within the fashion industry. PLM is much more far reaching, influencing how we tackle product design and CAD, compliance, sustainability and exciting developments within 3D and the Internet of Things.

Although my learning into PLM is only in its infancy, what I will take away from my first year in learning is that PLM isn't just software to improve existing practises. PLM exists to help change our thinking and approaches within the industry; in turn this will enable the industry to become more collaborative, more innovative and more responsive to the changes that are happening as we speak.

Expectations of entering the industry

I believe, and I doubt I'm alone, that PLM is gaining a huge amount of buzz within the fashion industry. It isn't a new concept by any means, but it seems the hype is relentless. During this year we have been introduced to a staggering number of brands that have started their journey implementing PLM ...and this number is only rising. That in itself is a huge indication that if you, as a business, do not currently have PLM or any plans to introduce PLM then a discussion needs to be started. Now is the time.

During my second year of study I have been applying for placements and it is has been so interesting to see how a knowledge of PLM can give me an advantage over my competition when attempting to enter the industry. During our studies WhichPLM have been generous enough to afford my peers and myself the opportunity to complete our WhichPLM Academy bronze module, which places us at a distinct advantage.

I have had first-hand experience of how PLM can give me an advantage. Sitting in one particular placement interview, as my CV was placed in front of the interviewer, I stole a quick glance; I was thrilled to see that my experience with PLM had been enthusiastically highlighted.

Although it *was* highlighted, the interviewer seemed unwilling to press the subject further, perhaps struggling themselves to come to terms with the changes in thinking that PLM requires. This is exactly where I believe there lies an opportunity for the next generation of fashion industry professionals.

Because PLM does require a significant shift into how the buying, design, merchandising and other departments approach tasks, existing professionals may not be as well placed to exploit the full benefits of PLM as current and future students. Resistance to change, particularly on a scale such as this, is somewhat inevitable. While many more companies are happily beginning to see the potential of PLM, the expertise of a future generation, educated on PLM early in their careers, are going to be required in order to see full implementation of PLM and its full potential being reached.

This is where I feel that expectations in the industry are beginning to shift too. Companies may need the knowledge of Generation Y, or the 'millenials' as we're now dubbed (the generation who has grown up surrounded by and unafraid of technology), in order to achieve full deployment of a PLM system that is certain to bring in valuable returns.

Appendix 19 Digital storyboarding innovation day

DIGITAL FASHION FUTURES

INNOVATION DAY WITH PETS AT HOME, WHICHPLM AND PTC

Friday 23rd February | 12.00pm | SJ5/17
(Spärck Jones Building)
Register: innovationday-ptc.eventbrite.co.uk

University of HUDDERSFIELD
Inspiring tomorrow's professionals

Background

Retailing is becoming ever more competitive and consumers are becoming increasingly demanding, so retailers are responding to win them over. Whether it be with deliveries within one hour, placing orders online via one-click, subscription offers, various and increased promotional offers or personalised loyalty rewards. All of these encourage customers to part with their money and ultimately choose where, with and when and with what medium they want to shop.

The exponential growth of online retail has given customers an incredible amount of choice which means Designers and Buyers face the challenging task of creating new, exciting and innovative products at ever speed.

Digital storyboard solutions can offer compelling, time critical environments for collaboration and creative design, development, and planning activities during the earliest stages of the product lifecycle.

How are pet products relevant?

You will all be aware that high street fashion is heavily influenced by the designs and concepts you see from high fashion houses.

Similarly, at Pets at Home we are constantly inspired and influenced by fashion and homeware retailers and humanization continues to be one of the biggest trends in our industry crossing all elements of food and accessories; and all animal types.

Task

Using PTC's canvas tool, we would like you to create a mood board that concepts show an exciting new pet product or category that Pets at Home could potentially bring to market.

Four areas we will look at are:

- Pet Fashion
- Pet Sleep Solutions
- Pet Technology
- Pet Subscription Box

whichPLM pets at home ptc

Appendix 20 LinkedIn group for fashion and textiles

Conlon, J., Taylor, A., Ashruff, P., and Bird, L. (2017) *LinkedIn Groups: Building a community to create real connections to benefit students and alumni in Fashion and Textiles.* In: University of Huddersfield Teaching and Learning Conference 2017, 13 September 2017, University of Huddersfield. Retrieved from http://eprints.hud.ac.uk/id/eprint/33499/

Conlon, Jo (2017) *Connecting students, alumni and employers?: there's an app for that.* NiTRO, the online publication of the Australian Council of Deans and Directors of Creative Arts (9). Retrieved from

https://nitro.edu.au/articles/2017/8/17/connecting-students-alumni-and-employers-theres-an-app-for-that?

LinkedIn has been described as the non-sexy, sleeping giant of social media (Buck, 2012). It has become the premiere social media site for professionals; most employers in the UK will search for a job candidate on LinkedIn. This makes it very useful when searching for jobs internships, exploring careers or accessing company information.

Yet, while students may be active on other social media platforms they are less engaged with LinkedIn. Certainly, our creative students report that LinkedIn has little appeal, they

find the professional business persona off-putting and believe that having a job is a prerequisite for a profile.

Additionally, for LinkedIn, students and graduates are the fastest-growing demographic, with LinkedIn graduate established in 2011 and the LinkedIn graduate app in 2016. LinkedIn has many capabilities that facilitate the type of networking students must engage in to find internships, jobs and make professional connections (Cooper and Naatus, 2014). From a personal branding perspective, LinkedIn offers users the opportunity to differentiate themselves in competitive job markets by creating a professional profile. It is important to note that in most Google searches a person's LinkedIn profile comes up as top of the search, it is therefore important this makes a good first impression. The LinkedIn profile tells a story about you – so does not having one.

This article reports on an internally funded project: *LinkedIn groups in higher education - Maximising community benefits for students & alumni in fashion & textiles*, which aimed to establish a supportive, collaborative community to leverage the vicarious experiences (Bandura, 1977) of our students and alumni to encourage students to begin building a professional identity and network which will be vital to their career progression. The grant paid for a student co-researcher to work with academics, the careers service and marketing.

Getting started – Build a profile

Although LinkedIn is more than an online, highly visible CV, the user profile is the starting point. LinkedIn measures profile strength from 0 to 100% and unlike other social media this requires a significant and ongoing time investment. The careers service partners deliver LinkedIn workshops at beginner and advanced level to all current students; through these hands-on discussions and troubleshooting sessions, students repackage the embedded skills in academic work and part-time work to showcase their experience and abilities in an initial profile. This is the important first step to develop a strong identity and sense of self-worth to enter competitive job markets with confidence.

This then needs to be coupled with overcoming the fear of putting yourself out there in an unfamiliar environment. A means of support to bridge the confidence gap between current and emerging professional identities is needed. It's also important that students recognise the difference between connecting with friends and family on sites like Facebook and networking with unknown professionals.

Discover - existing and peripheral contacts

A significant component of a strong, visible profile within LinkedIn is having 50 connections. LinkedIn does have a number of features to assist in building connections. We encourage students to grow their network organically and to be cautious in accepting indiscriminate connection requests. The LinkedIn facility of scanning existing email contacts shows who's on LinkedIn already, and facilitates connection requests. LinkedIn has many groups organized around industries and functional areas and groups provide a mechanism to build connections with others around a common interest or organisation. It is this feature that was leveraged in this project; forming a university student and alumni group provides a 'safe space' and the opportunity to connect with peers in their cohort, in other years of the same course, with other students in the department and near-peer alumni. Existing students particularly those returning from work placement serve as important role models. We have found that our alumni often are very pleased to offer their advice, provide internship and job leads, and return to give guest lectures. Near-peer alumni offer a powerful combination of the benefits of peer and mentor relationships. We ask our students to seek out our guest speakers on LinkedIn to offer their thanks and comments on the talk and to request to connect.

Participate

It was envisioned that the group would share news, knowledge, work experience and job opportunities. Currently we have established an appreciated repository but are keen to get all members contributing in an active community to prevent it sliding into an alternative space to teach from. We are establishing a hub of LinkedIn champions to regularly pose questions that will evoke a response. We are also currently seeking to identify where LinkedIn can fit seamlessly into class activities and assignments and provide opportunities for members to contribute and recognize that their voices are important. For example, making a conversational post on a news article ahead of a class discussion or tutorial, adding a link to a blog post or online portfolio seeking feedback, seeking recommendations and endorsements to build their profile, researching the profile behind job roles, using geographical features to conduct a search to identify potential businesses in an area, conducting market research for an assignment, identifying potential interviewees for primary research and sharing these experiences in the safe space of the LinkedIn group. We see the opportunity to demonstrate the potential of LinkedIn beyond its human resource management applications and to teach students how to use it as a collaborative medium (Wankel, 2016) to support others and feel part of a community that places a premium on quality intellectual exchange (Gershbein, 2016).

Appendix 21 Early adopter vignettes

[Name] joined the University in 2013 with A-levels in Art & Design: Textiles, Art & Design: Photography, Film Studies and Media Studies totalling 340 *pre-17 UCAS tariff* points. Her hometown is York and therefore [Name] moved to Huddersfield to live in the area as a full-time student for first year before commuting for the remaining two years to Huddersfield. She chose the programme at Huddersfield because of the diversity of the course and the variety of possible outcomes following completion. Many courses specialise in one focal career path; however, the Fashion Textiles Buying Management course leaves many doors open.

[Name] would describe her student experience before placement as challenging as students are unaware of the working environment and the adaptation from classroom learning to commercial awareness, decision making and problem solving on the job sometimes without further guidance.

After the PLM event week, [Name] had the opportunity to work at George as a result of winning a competition through University, which the group presented an athleisure range designed and constructed through PLM software to present for George and the George customer. She also undertook a placement at another Head Office prior to the George experience, gaining insight and knowledge into the infant and baby essentials category within buying. [Name] also undertook a placement year between Y2 and final year. This industrial placement was as an Import Merchandiser at a supplier to the licenced childrenswear market. This placement appealed to [Name] because of the experience developed in my previous retail head office experience and my previous work within childrenswear. She particularly benefitted from this work experience as this has now led to managing customer accounts for two retailers whilst working in imports as a supplier to now working for fast fashion chain.

[Name]’s feelings about returning to complete the final year were positive because she realised that her placement had given her excellent experience and confidence in the fashion industry on a global scale and how this could be applied to future university projects. This experience influenced her research interest in final year, as she graduated with a second upper class honours degree in 2017. She would describe her time as a student at Huddersfield as enjoyable and an eye opener to prepare for a sustainable career in the fashion industry.

Immediately after graduation she was successfully recruited to join a supplier to leading fashion retailers working for childrenswear supplier, before moving to her current role in fast fashion business. She describes this as a complete transition from the other previous areas of work, childrenswear being predominantly slow paced with heavy QC regulations to adhere to; to now working in women's fast fashion working on three-week lead times. Her best career moment to date was the opportunity to gain first-hand training into newly developed PLM/ERP systems implementation. In the upcoming future, she hopes to progress and develop within the brand and their partners.

To potential students [Name] would like to say to ensure you find an area of the industry in which you find exciting yet challenging, and attempt to gain as much experience as you possibly can within that area. If there is not a significant point of interest for you to focus your studies towards, try looking into a variety of areas and finding out which appeals to you the most. Placement year is exceptionally valuable regardless of the company and their position, every company works differently and you will learn different things which you can take to final year and these will be like gold dust when it comes to completing your dissertation. Finally, good luck!

[Name] joined the University in 2011 with A-levels in English Literature, Art, Textiles and Business Studies. She is from a very small village in Somerset which is 240 miles away, and therefore [Name] moved to Huddersfield to live in the area as a full-time student. She felt the course had a lot to offer, that the student village accommodation and general area also seemed very appealing.

[Name] felt a lack of focus in her first and second years, becoming fully immersed in 'student life' with studies somewhat on the back burner. The course team commented that [Name] was clearly capable of more. [Name] secured a 12-month placement with a premium quality cosmetics company based in London. This placement appealed to [Name] because she had always had a great love of nail varnish and nail art, and the opportunity to see Product Development in the real world, whether this was textile specific or not, was extremely appealing. She particularly benefitted from this work experience by being part of a very small Product Development team meaning [Name] was exposed to ways of workings across the whole business, and gained a lot of responsibility. She also witnessed and was a party to, the implementation of an ERP system to the brand, which later sparked her interest in operational excellence and change within fashion businesses.

[Name]'s feelings about returning to complete the final year were mixed, because her placement had been in beauty, she was concerned about her ability to apply what she had learnt to the course specifically, but she felt very determined. She realised that her placement experience and given her a good grounding to undertake research in retail systems which reinvigorated her motivation towards the studies and she graduated with a first-class honours degree. She would describe her time as a student at Huddersfield as challenging, inspiring, enlightening and ultimately a priceless experience. She comments particularly on finding connections and transferrable skills, and never feeling like you should be pigeonholed because of past experiences – learning can be applied across so many different industries and inspiration and focus sometimes comes from where you least expect it!

As part of her Final Major Project, [Name] worked within the University's enterprise unit to develop a business idea of hers. However, before she had the opportunity to take this any further, even prior to her graduation, she was successfully recruited to join a large high street fashion retailer. She worked for the group for just over a year before being recruited by a luxury brand to join their PLM implementation team where she has now progressed to her current role as 'Change Analyst'. She describes her first role as extremely challenging and sometimes terrible, but completely necessary for her understanding of how a fashion retail business generally works. She relishes now in seeing the bigger picture working as

part of a Project team that works with so many functions across the business, helping to improve processes and make meaningful change to such a large organisation.

To potential students [Name] would like to say that a degree is invaluable. In an exceedingly competitive industry that a degree is not always necessary to get into, your academic experience and application of it to real businesses will take you so much further than those without. Take every opportunity you can, whether you think it is relevant or not, it could turn out to be the best thing you ever did! Work hard and never stop trying, and there is always space to improve and grow and learn. [Name] would also like to add that her dreams of seeing through her business idea conceived in her final year are still alive and kicking! So, watch this space.

[Name] joined the University in 2011 with A-levels in Business Studies, Textiles Technology, Biology & General Studies, totalling 320 UCAS points. Her hometown is Windsor, 200 miles away, and therefore [Name] moved to Huddersfield to live in the area as a full-time student. She chose the programme at Huddersfield because after researching multiple courses she found that the course at Huddersfield matched closest to her desired results from the course – such as focusing more on the business aspect in fashion and not on design. Also, when visiting different universities, Huddersfield students collectively seemed the happiest with their choice in terms of University life but also the course work and lecturers involved.

[Name] would describe her student experience before placement as informative and well round because the different modules ensured that lots of different aspects from the fashion industry were covered and not just focused on certain topics.

The industrial placement was as a Trainee Assistant Merchandiser. This placement appealed to [Name] because, initially she thought merch would be a better route as she enjoys maths and thought both buying and merch would be similar but one with more maths involved. She particularly benefitted from this work experience as it made her realise that merch was not the career choice to go into but it also helped her in the long run as she then had multiple advantages over others when entering the workplace in buying.

[Name]'s feelings about returning to complete the final year were excited but also slightly nervous as taking a year out from student life, she didn't know how quickly she would settle back into the 'school' feel. She realised that her placement had given her excellent experience and an invaluable insight in the 'real-life' world of fashion retail and an interest and determination to improve systems and she applied this and graduated first class honours degree. She would describe her time as a student at Huddersfield as excellent. She comments particularly on the support received from lecturers, the community feel from the school, the willingness to teach and learn from the students and the work set that was very practical to the course.

Immediately after graduation she was successfully recruited to join a fashion retailer as BAA but joined another retail brand as AB after two years, where she left in December. [Name] has now moved out of buying and has started work for the leading global trend forecasters as a Business Development Associate. Her best career moments to date were being the fastest promoted BAA to Senior BAA in her fast role that the company had, introducing the plus size range at her second company and having the courage to take the jump from

buying to sales. She hopes to achieve a successful career within sales using her experience and knowledge from buying as an advantage.

To potential students [Name] would like to say 'go with your gut, when you enter the fashion industry – it can be hard, everyone is fighting for the next level but if you focus on you and ensuring your work helps the team succeed this will be noticed and you will succeed. University sets you up for this, even if a module isn't your favourite still try your hardest at it as knowledge is power and everything you can learn will help you later down the line. Finally, it's Uni – enjoy it!'

[Name] joined the University in 2011 with A-levels in Textiles, Media Studies, Business Studies; General Studies and an AS in Photography, totalling 410 UCAS points. Her hometown is Manchester and therefore [Name] moved to Huddersfield to live in the area as a full-time student. She chose the programme at Huddersfield because of the University's excellent resources and smaller class sizes, which made for a more supportive and inclusive way of learning.

[Name] achieved 2:1 in her foundational year and a First in her intermediate year studies. [Name] would describe her student experience before placement as eye-opening because she was able to work on a variety of different subject matters with new people; which allowed her to discover what she enjoyed, build new strengths and understand her weaknesses.

After the PLM event week, [Name] had the opportunity to work at George because she and her team impressed the judges with their presentation using PLM to develop an activewear range and gaining first place in the event. She then undertook a placement at clothing business as a design and merchandising assistant. The industrial placement was a great opportunity to use the skills she had learnt at University and apply them to real life work situations. This placement appealed to [Name] because the role included a mixture of business acumen and creative research at a highly recognised company within the industry. She particularly benefitted from this work experience as it helped build confidence and an insight into developments within the industry to apply to her studies.

[Name]'s feelings about returning to complete the final year were fuelled by determination because she realised that her placement had given her excellent experience of issues the industry currently faces to enhance her research. This experience influenced her research interest in final year and supported her in subjects that she would not have been confident in without her varied experience. She graduated with a first-class honours degree in 2017. She would describe her time as a student at Huddersfield as rewarding. She comments particularly on having time to research and explore a subject matter that she felt passionately about, allowing her to create something that she was truly proud of.

Immediately after graduation she was successfully recruited to join a supplier to leading fashion retailers but has since succeeded as a product developer for a cosmetics supplier to a prominent high street retailer. She describes this as a refreshing change of direction. Her best career moment to date was playing an important part in launching a highly publicised range that went on to winning a vogue beauty award. She hopes to continue to learn new skills and continue to develop innovative designs and products.

To potential students [Name] would like to say use this time to develop and strengthen yourself and connect with as many people as you can. It will not only strengthen your results at University but will also support you in your future career.

[Name] would also like to add that her decision to study at Huddersfield University was the best decision she has made to date.

[Name] joined the University in 2011 with A-levels in Business, Economics, Finance and Textiles, totalling 144 UCAS points. Her hometown is Runcorn (Cheshire), 55 miles away, and therefore [Name] moved to Huddersfield to live in the area as a full-time student. She chose the programme at Huddersfield because she believed she would develop a wide range of skills from commercial awareness to communication skills to support her to become a confident player in the fashion and retail industry. [Name] also wanted the opportunity to experience an industrial placement which the programme at Huddersfield enabled her to do.

[Name] achieved 2:1 in her foundational year and intermediate year studies. [Name] would describe her student experience before placement as interesting and broad because the programme had such a wide scope of different modules from Marketing to Fibre to Product. [Name] found that she built a solid foundation of knowledge and understanding of the Fashion industry which lead her nicely into her placement year.

The industrial placement was as a Merchandising Assistant at a clothing retailer. This placement appealed to [Name] because she was interested in the numerical and analytical aspects of the Merchandising function within the fashion industry, as well as gaining experience at a multi-channel retailer with an extensive store portfolio. She particularly benefitted from this work experience as placement had given her invaluable experience working first hand collaboratively with the buying team to land a successful product range.

[Name]'s feelings about returning to complete the final year were enthusiasm, as she was excited to translate her first-hand knowledge and experiences from her placement into successful final year projects. She realised that her placement had given her excellent experience and an invaluable insight in the 'real-life' world of fashion retail and an interest and determination to improve systems and she applied this and graduated first class honours degree. She would describe her time as a student at Huddersfield as invaluable and interesting. She comments particularly on the broad array of modules, support from industry experienced tutors and connections with the industry to help secure industry placements.

Immediately after graduation she was successfully recruited to join a large value fashion retailer where she still works. She describes this fast paced, challenging yet rewarding. She hopes to achieve the role of Merchandiser within the next few years, where she will have full ownership of planning and trading several product areas and managing a team. Within doing this [Name] strives to add value to the business through capitalising on opportunities and providing the best customer experience possible.

To potential students [Name] would like to say the programme is wide-ranging and exciting, which will open various doors in to the fashion industry from Fashion Merchandising to Fashion Buying.