Power, Jess

Devising a product development curriculum to promote industry ready apparel graduates.

Devising a Product Development Curriculum to Promote Industry Ready Apparel Graduates

E. Jess Power

Research Degrees Coordinator
Senior Lecturer in Fashion Technology
Manchester Metropolitan University
Department of Clothing Design and Technology
Faculty of Food, Clothing and Hospitality Management
Hollings Campus
Old Hall Lane
Manchester
M14 6HR
j.power@mmu.ac.uk

DEVISING A PRODUCT DEVELOPMENT CURRICULUM TO PROMOTE INDUSTRY READY APPAREL GRADUATES

Power, E. J.
Manchester Metropolitan University, UK.

ABSTRACT

Globalisation has continued to dominate the apparel industries worldwide accelerating at an ever changing pace. Many authors have acknowledged that it is not enough for graduates to have passed assessments they must have developed a high order of cognitive skills and enthusiasm for their selected career. The development of lifelong learning skills promotes metacognitive strategies which are essential for survival in the rapidly changing clothing industry. This paper presents the curriculum development for a new unit entitled Technologies for Specific Product Development. This newly designed unit focuses on the synthesis and critical evaluation of innovative technologies specific to the advanced sportswear market. It encompasses a variety of technologies including 3-D scanning and body morphology, material science and FAST objective testing, seam engineering, cutting technology and 3-D garment modelling (utilising V-stitcher). The teaching and learning strategies incorporate the principles of active learning to promote critical thinking, analytical and self development skills to ensure graduates are industry ready. Throughout the curriculum there is a strong focus on; technology (source novel, emerging and new technologies), the development of higher order cognitive skills (analysis, synthesis, and evaluate), and personal skill development, based on the generic knowledge and understanding, attributes and skills listed in the QAA (2008) subject benchmarking statements.

Keywords: Employability, Metacognition, Active learning, Higher Education.

1.0 Introduction

Historically the textile and clothing manufacturing industry in the UK has been an economically important sector (Jones, 2002). However, the vast decline in UK manufacturing towards the last quarter of the 20th century saw a shift towards global apparel production. This was partly brought about by the high labour costs, which was apparent in most developed economies (Jones, 2002; Walter et al eds, 2009). Globalisation has continued to dominate the apparel industries worldwide, accelerating at an ever changing pace (Eckman & Frey, 2005; Jacob, 2007; Walter et al eds, 2009). It has been reported by many that no sector of business is more global than the textiles and apparel (Dickerson, 1999; Jones 2002) thus, providing many dynamic opportunities for higher education (HE) graduates that are skill and knowledge ready. Recent HE reforms have identified that the UK is no longer in a position to compete with low wage, low skill manufacture. ‘As a developed country we are operating at the knowledge frontier’ (BIS, Nov 2009, p.5) and as such skills that relate to the globalised knowledge based economy are demanded. A report published by BIS acknowledged that ‘highly skilled people with excellent technical business and life skills are the blood of innovative organisations’ (Feb 2010, p.32). In order to compete in an increasingly competitive global economy HE graduates require equipping with the necessary skills to contribute to a knowledge intensive workforce (Russ & Dickenson, 1999; Hawley, 2005; Kimmons & Spruiell, 2005; BIS, Feb 2010). Many authors have acknowledged that it is not enough for graduates to have passed assessment they must have developed skills of problem solving, teamwork and enthusiasm for their selected career (Carpenter & Fairhurst, 2005; Hawley, 2005; Kimmons & Spruiell, 2005; Fiore et al, 2005).

2.0 Skill development within HE

In the last decade UK higher education reforms (BIS, Nov 2009) in terms of student contribution and methods HE engages with the wider economy have promoted a climate for research into andragogy. Peter Mandelson (First Secretary of State), acknowledged that 'this country's future can only be built by educated, enterprising people with the right skills; the skills demanded by modern work in a globalised knowledge economy. Skilled people are more productive, they are more innovative, and they build stronger businesses' (BIS a, Nov 2009, p.2). In order to be competitive graduates need to be industry ready, possessing the necessary professional and technical skills to ensure success in the modern work world. A view supported by many modern researchers of andragogy (Laughlin & Kean, 1995; DeLong et al, 1997; De Gallow, 2000; Fiore et al, 2005; Eckman & Frey, 2005; Hawley, 2005; Kimmons & Spruiell, 2005; O'Neal, 2007; BIS, Feb 2010). Various typologies exist in relation to general skill categorisation, however, they all can be aligned into the 6 broad definitions identified in the QAA subject benchmark statements (QAA, 2008), illustrated in Table 2.1.

Table 2.1: Generic Knowledge and Understanding, Attributes and Skills (QAA, 2008)

Generic Skills	***Students will have the ability to….***
Self-management	- study independently, set goals, manage their own workloads and meet deadlines. - anticipate and accommodate change, and work within contexts of ambiguity, uncertainty and unfamiliarity.
Critical engagement	- analyse information and experiences, formulate independent judgements, and articulate reasoned arguments through reflection, review and evaluation. - source and research relevant material, assimilating and articulating relevant findings. - formulate reasoned responses to the critical judgements of others. - identify personal strengths and needs, and reflect on personal development.
Group working	- interact effectively with others, for example through collaboration, collective endeavour and negotiation.
Communication	- articulate ideas and information comprehensibly in visual, oral and written forms - present ideas and work to audiences in a range of situations - use the views of others in the development or enhancement of their work.
Information	- source, navigate, select, retrieve, evaluate, manipulate and manage information from a variety of sources - select and employ communication and information technologies.
Personal	- develop an enthusiasm for enquiry into their discipline and the motivation to sustain it.

In order to raise levels of employability, it has been identified that generic skills in teamworking, problem solving and communication must be improved (Carpenter & Fairhurst, 2005; Eckman & Frey, 2005; Hawley, 2005; Kimmons & Spruiell, 2005; Fiore et al, 2005). As Fiore et al (2005) acknowledged it is easy to blame the student for poor performance in terms of skill development. In reality it is often the fault of a passive teaching system (Fiore et al, 2005; Hawley, 2005) that provided no opportunity for the wider development of lifelong skills. Educators need to provide opportunities to encourage skill development appropriate to the cognitive development of HE students. Many authors have identified that a dualistic approach (a right or wrong answer) does not encourage the development of student's critical thinking skills, which may affect their long term contribution to the global market place (Laughlin & Kean 1995; DeLong, 1997; Fiore et al, 2005; Kimmons & Spruiell, 2005). The advancement of lifelong learning skills promotes the development of metacognitive strategies which are essential for survival in our rapidly changing world (Kimmons & Spruiell, 2005; Downing et al, 2007).

2.1 Cognition

Cognition can be described as the ability to learn and solve a problem. In the late 50's Bloom created a classification of learning objectives, the taxonomy as it became known was the foundation of creating a more holistic education (Bloom, 1956). The focus of the taxonomy was across three domains, affective, psychomotor, cognitive (emotional skills, development of skills, knowledge & learning skills). When authors refer to high order of cognition there is an expectation that the lower orders in terms of knowledge, comprehension and application have been successfully acquired (Atherton, 2009). Higher orders refer to the analysis, synthesis and evaluation (Eckman & Frey, 2005; Atherton, 2009). Whilst it is accepted that lecturers should be concerned with imparting knowledge there must be equal concern given to the process of cognition (Hawley, 2005). Generally speaking there are three principles to which Piagetian theorist agree (Driscoll, 1994): The learning environment should support the activity of the learner; The learners interactions with peers are an important source of cognitive development; and instructional strategies that make learners aware of conflicts and inconsistencies in their thinking promote cognitive development (problem solving). Numerous authors have recognised that cognitive development is influenced by social and cultural factors (Piaget, 1977; Kimmons & Spruiell, 2005; Downing et al, 2007; Downing et al, 2009). It was acknowledged that peer interaction and observation amongst other factors can impact on cognitive development and thus be utilised as a preconditioning for the training of reflective skills. Knowing your learner contributes effectively to creating and sustaining a supportive learning environment that actively promotes cognitive development (Piaget, 1977; Von Wright, 1992; Mayes, 1998; Cannon & Newble, 2000; Downing, 2001; Kadolph, 2005; Downing et al, 2007; Downing et al, 2009; Power, 2010).

2.2 Metacognition

In an increasingly global world it is essential that graduates are equipped with transferable skills (BIS, Nov 2009; BIS a, Nov 2009). 'Metacognitive strategies are essential for the twenty-first century because they will enable students to successfully cope with new situations, and the challenges of lifelong learning' (Downing, 2007, p.11). In its simplest form metacognition has been described by many as the thinking about thinking (Downing et al, 2007; Flavell, 1999; Downing et al, 2009; Power, 2010). It is much broader than understanding and creating an awareness of a task; it encompasses higher order thinking in term of analysis, the ability to direct thinking, and putting into practice what has been learned. It is widely accepted that in order to problem solve students should have some understanding of how they perform cognitive tasks (Marchant, 1989). Past research has shown that if a student feels confident in the ability to problem solve, they tend to perform better in assessment (Cornoldi, 1998; Hawley, 2005; Power, 2007; Power, 2010). A key feature of current HE education policy is the development of industry ready graduates; the challenge for HE is the integration of skill development into the curriculum which will not become obsolete.

2.3 Generic knowledge and understanding, attributes and skills

The development of a higher order of cognitive skills are essential prior to building controlled metacognitive strategies (Downing et al, 2007). It is an ongoing effort for HE establishments worldwide to provide quality educational programs that meet the requirements of an increasingly multidisciplinary business world (Eckman & Frey, 2005; Foire et al, 2005). Kimmons & Spruiell acknowledged that 'it is necessary to collaborate with professionals in other disciplines with different knowledge bases, vocabularies, and ways of working' (2005, p.385). Therefore, the development of generic knowledge and understanding will contribute to effective lifelong learning attributes and employability skills. The QAA subject benchmarking statements list 6 categories of generic skill development which include autonomous learning, critical & analytical thinking, teamworking, effective communication, computing & information synthesising and personal qualities. Kimmons & Spruiell (2005) amongst others (Hmelo et al, 1997) identified problem based learning (PBL) as a method to develop effective metacognitive and critical thinking skills. It was found in their study that when learners are given the opportunity to invest in an issue they tend to take ownership.

2.4 Problem based learning

Problem based learning has origins and is well documented in the discipline of medicine (Cannon & Newble, 2000; Kimmons & Spruiell 2005; Downing et al 2009). However, different disciplines have adapted this learning strategy to meet their specific requirements. PBL is a delivery system in which the problem is central, quite often the emphasis is on collaborate working and the problem is only vaguely defined to enable the process to be established by the learner (Kimmons & Spruiell, 2005). The key aspects of PBL are that it forms real world challenges thus, providing an authentic learning experience in the selected subject area; at least part of the goals are determined by the students themselves (DeGallow, 2000), and there are no right or wrong answers a variety of solutions are possible based on the application of knowledge and skills (Carpenter & Fairhurst, 2005; Kimmons & Spruiell, 2005; Downing et al 2009). This learning style directs the student into unfamiliar territory and thus creates a suitable environment for skill development, provided that the appropriate support is in place. Downing et al (2009) refers to this as the support scaffolding, others refer to supportive frameworks (Fiore et al. 2005, Power, 2010). The lecturer's role changes to facilitator and the focus is on the learners actions. Hmelo et al (1997) concluded from their study that the students that engage in PBL can be distinguished from their counterparts in terms of knowledge, reasoning and learning strategies. It appeared that PBL developed analytical approaches in realising a solution to a task in addition to self development skills.

3.0 Active learning strategies

Active learning is defined by McGill & Beaty (2001) as a supported continued process of learning and reflection. It is not a new concept since active projects have origins in industry where tasks are identified in order to increase knowledge of a specified problem (Knowles, 1980). Within an education context Knowles (1980) identified two learning models (organic and operational). The organic approach defines the learning objectives but the learner devises a suitable method of achieving them, whilst the operation process provides a more structured supportive framework. Independent of the learning model one feature is common, the learner is actively engaging in the task. Prior to engaging upon this style of teaching all activities should be considered in detail. As Hawley (2005) identified active learning should add value to the class and enable the development of deep and high order cognitive skills. It is worth noting that there are many typologies of learner styles and it is unlikely that one teaching method will be suitable for all students. Therefore, it is essential that activities are designed to support both group working and individual working. Various studies have demonstrated that students prefer active engagement enabling them to secure a concrete learning experience at the point of delivery, studies also support a general trend to higher academic achievement (Schroeder, 1993; Hawley, 2005; Power, 2007; Power, 2010). Active learning provides opportunities for the development of higher order cognitive skills and encourages deep learning, especially if employed in team working scenarios combined with PBL. Previous studies have associated this style of teaching and learning with the development of autonomous skills (Kember, 2000; McGill & Beaty, 2001; Kelly, 2004; Hawley, 2005; Power, 2010).

4.0 Large group teaching

When teaching large cohorts careful consideration must be given to a number of factors including, the environment, the learners past experiences, resources available, assessment and previous teaching methods (just to name a few). One of the most common problems associated with large cohorts is that traditional lecturing methods don’t provide opportunities for active participation (Cannon & Newble, 2000; McGill & Beaty, 2001; Neary, 2002; Hawley, 2005). It is well documented that students are unlikely to ask questions or indeed answer them in a large group setting. Teaching large cohorts is more time consuming than teaching smaller groups and therefore the temptation is to utilise passive teaching methods (Hawley, 2005). However, this does not promote the development of higher order cognitive skills (analysis, synthesis and evaluation). Active learning has been identified as a strategy to promote the development of this skill set however, introducing this learning style into a large group may be seen as unmanageable (Hawley, 2005; Power, 2010); particularly in terms of preparation. However, with careful planning this can be minimised by utilising group working and incorporating elements of PBL which will promote the development of metacognition, in addition to extending subject knowledge and higher order cognitive skills. Concern may be expressed that changing to this style of learning will reduce the taught curriculum contents, this is true. However, Hawley’s (2005) research (supported by others) indentified that quite often the elements consciously omitted will be discovered during the active learning and will thus enable a deeper understand to be obtained. It is not within the lecturer’s powers to guarantee the learning will be deeply embedded. However, it is within their remit to provide a classroom environment to support the activity of the learner. The ultimate outcome is to enhance the learner experience through the development of their metacognitive and higher order cognitive skills to produce industry ready graduates.

5.0 Technical skills for apparel

The increasingly global nature of the apparel industry has seen a shift in the functions within companies. The design, marketing and distribution being based in the developed nations, whilst manufacturing tends to occur off shore in low cost locations worldwide (Jones, 2002; Jacob, 2007, Walter et al eds, 2009). Some authors predict that the knowledge work is increasingly becoming more internationalised with location pockets developing, offering specific expertise in various areas particularly in high technology/ innovative product developments (Jacob, 2007). The global distribution of knowledge brings many opportunities for collaborations enabling SME to compete with multinationals in the area of innovation (Jacob, 2007). Friedman predicted that '…the tech revolution is likely to constitute a new cast of winners and losers' (Jacob, 2007, p.354). Already technology related efficiency has reduced apparel lead times significantly. New development and innovation is set to change the way we approach product development. One area of new product development is the integration of technologies to enable virtual simulation of garment production. The aim of this process is to cost save in the areas of design and prototyping (Goldstein, 2009); however, the technology has potential far reaching benefits in areas of technical garment development if utilised effectively. The simulation of a garment involves the integration of knowledge from different disciplines including body morphology, material science, design, pattern, seam engineering and garment technology. Goldstein, (2009) identified that 3D computer aided design (CAD) within apparel is lagging behind other industries. This is in part due to the difficulties in mapping the human body and complexities regarding true to life simulation of material drape. However, since the introduction of CAD/CAM in the 70s significant progress has been made. The innovation in the technology is now moving at a rapid pace; it is therefore essential that graduates have an understanding and knowledge of what is available to them and the implications of utilising CAD/CAM to assist in advanced product development. When considering technology within an educational context it is essential that the global nature of the apparel industry is considered, it has already been identified that in a professional environment it is essential to be able to communicate with other disciplines with substantially different knowledge and technology bases. Kimmons & Spruiell (2005) expressed that restricting problem based learning within one course to one discipline limits the learning experience. Fiore et al (2005) commented that a learner, who understands knowledge relationships, can focus on a systematic evaluation of an argument, skills that are essential to advanced critical thinking. In addition to this Fiore et al (2005) indentified in their study that superficial integration across subject matter is one of the major causes of lack of critical thinking. Finally there is one area that has been overlooked so far in this publication, this is the integration and collaboration between academia and industry. If a technology curriculum is to be complete it must have some integration with industry. Jacob acknowledged that '…real-world experts bring content area knowledge and professional life experience to the classroom' (2007, p.354).

6.0 Unit development

To enable the development of the higher order cognitive skills a new unit was incorporated into the final year clothing course (level 6 NQF). It is not the unit criterion that is to be discussed within the paper it is the curriculum development that is a primary factor. However, it would not present a clear focus if this was not addressed in at least some detail. The unit objective was to provide the opportunity to synthesis, critically analyse and evaluate novel, emerging and new technologies in relation to a specific end product. Six skill criteria's were to be assessed within the unit which fitted into the categories identified in Table 2.1 with a key emphasis on working effectively as part of a team. The unit constituted 16.67% of the final year mark (20 credits) and was delivered over a period of 25 week across two terms. This equated to 50 hours of class contact. The assessment outcome was a combination of coursework and a 30 minute team presentation.

6.1 Method

Prior to developing the unit curriculum an overview was taken into how this would and could integrate with other units. Thus, supporting the theory that to
a learner who understands knowledge relationships, can focus on a systematic evaluation of an argument, skills that are essential to advanced critical thinking and will have an improved learning experience (Fiore et al, 2005; Kimmons & Spruiell, 2005). The model presented in Figure 6.1 was created to illustrate the integration across three independent units, although it should be noted that the project was only assessed in 2 of the units and within the design element it contributed to only part of the final grade.

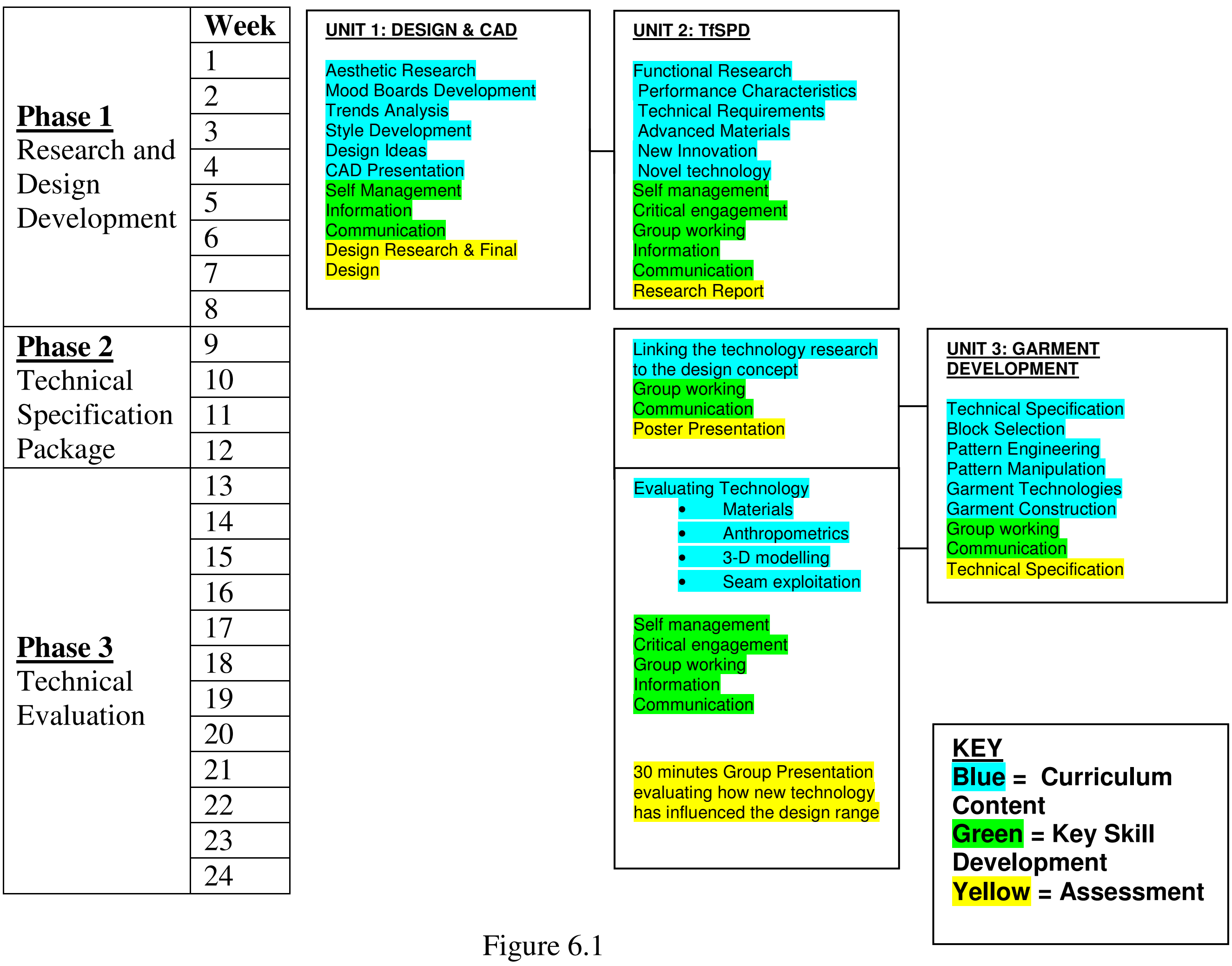

Figure 6.1
Model to demonstrate unit relationships for sportswear project

This was presented to the students in the TfSPD unit using a 3 phase approach (discussed in paragraph 6.2). Prior to formal approval of the assessment an external contact from industry was approached on an informal basis to discuss the relevance of a project of this nature in terms of skill development, technology awareness and producing industry ready graduates. The feedback received was in overwhelming support for the project rational and encouragement for our endeavours. The project was geared to sportswear since this was considered a high-tech area for innovation across all the apparel disciplines and given that a major sporting event (Olympics 2012) was on the horizon, it was anticipated that enthusiasm and commercial interest would be at a high level and evident across the array of information sources. The first delivery of this unit was 2009-2010 to a cohort of 80 students at level 6. Of course a project of this size and nature could not be delivered by a single academic nor was it ever intended to be so. The actual unit was supported through a series of guest lecturers, learning support, team teaching and master classes. It involved input from 8 academics, various technicians, industry contacts and learning support. The resources both in terms of academic staff, technical support, technology, and rooming proved to be a substantial investment for the department.

6.2 The project

The overall project identified in Figure 6.1, was split into 3 phases. Phase 1 was the research and design development, which involved the Design unit and Technologies for Specific Product Development (TfSPD) unit working to similar briefs. Product development teams (PDT) of 6/8 individuals were randomly selected which spanned across the entire project. The PDT task was to produce a collection of functional outfits (menswear) for the summer Olympic Games (2012) for an event of their choice. The design unit focussed on the aesthetics and the TfSPD unit focused on the functionality. The units ran independently although the research for the TfSPD fed into the design process and vice versa the assessment was individual for each unit. The second phase of the project was the technical specification package, which involved the PDT synthesising all the technologies utilised in the design collection and communicating this though a range of professional posters; and the selection of one outfit which was to be developed into a prototype package (working drawing, technical specification & material selection) intended to be manufactured by a professional seamstress. The final phase (phase 3) was concerned with the evaluation of the technologies and reflection of the product developed, it involved team teaching in relation to the various specific technology areas and assessment was in the TfSPD unit only through a 30 minute team presentation.

6.3 TfSPD Unit development

The primary purpose of this unit was to a) Sources and synthesis available information on novel, emerging and new technologies relevant to the creation of a specific end product; b) critically analyse data pertinent to selecting appropriate technologies for the generation of a specific end product; and c) evaluate the selected technologies and communicate this in written, visual and oral form. Active learning was identified as a suitable teaching method since this provided the opportunity for the development of higher order cognitive skills (analysis, synthesis and evaluation) and encouraged deep learning. Previous authors (Fiore et al, 2005; Downing et al 2009; Power, 2010) have acknowledged that active learning strategies are effective but careful consideration must be given to the approaches used since it cannot be presumed that all learners at this level will have developed to the same degree of autonomy. It is therefore advisable to use an operational model which provides a supportive framework, since some learners will be in unfamiliar territory. This model enables the learners to determine at least some goals and devise action plans to realise them but provides a safety net in terms of possible tutor intervention. The framework for learning is illustrated in Table 6.1 and will be discussed in the paragraphs to follow.

Additional elements to address within the unit where equipping the learners with the necessary skills to i) contribute to an increasingly knowledge intensive workforce and ii) be competitive in the global economy. Generic skill development was evident throughout the unit and is mapped against the activities in Figure 6.1. In relation to the evaluation of specific technologies the newest area of product development was selected for investigation in the spring term which involved the integration of technologies to enable virtual simulation of garment production. This encompassed a variety of technologies including 3-D scanning and body morphology, material science and FAST objective testing, seam engineering, cutting technology and 3-D garment modelling (utilising V-stitcher).

Finally when identifying teaching and learning strategies suitable for large cohorts it is essential that past experiences and previous teaching methods are taken into account. It was acknowledged that although students on the course had experienced active learning strategies at previous levels, a large percentage (25%) of learners were direct entry at level 6 and it could not be assumed that they had ever experienced this kind of learning style. Therefore, the first two weeks (and week 5) encompassed aspects of study skills into the delivery to ensure the learners fully understood the learning style.

Table 6.1: Framework for Learning

<table>
<tr><th colspan="2">TERM 1</th><th colspan="2">TERM 2</th></tr>
<tr><td>Week</td><td></td><td>Week</td><td></td></tr>
<tr><td>1</td><td>Introduction to the unit</td><td>13</td><td>Introduction to innovative technology</td></tr>
<tr><td>2</td><td>Active learning strategies</td><td>14</td><td rowspan="8">Four groups rotating on a 2 weekly basis between 4 technology seminars

a) 3D scanning / body morphology
b) Material science / FAST
c) Seam engineering / cutting
d) 3-D garment modelling / V-stitcher</td></tr>
<tr><td>3</td><td>Performance materials</td><td>15</td></tr>
<tr><td>4</td><td>Technical seams</td><td>16</td></tr>
<tr><td>5</td><td>Effective reflection</td><td>17</td></tr>
<tr><td>6</td><td>Anthropometrics</td><td>18</td></tr>
<tr><td>7</td><td>Virtual garment simulation</td><td>19</td></tr>
<tr><td>8</td><td>Assessment guidance</td><td>20</td></tr>
<tr><td>9</td><td>Poster presentation guidance</td><td>21</td></tr>
<tr><td>10</td><td>Group tutorials</td><td>22</td><td>External guest lecture (technology)</td></tr>
<tr><td>11</td><td>Peer meetings</td><td>23</td><td>Group tutorials</td></tr>
<tr><td>12</td><td>Peer meetings</td><td>24</td><td>Assessment Guidance</td></tr>
</table>

6.3.1 Autumn term delivery

Initially the large cohort was split into 12 small PDT, which equated to approximately 6 learners per team. The learners entry behaviour was carefully considered to ensure teams were formed from a combination of direct entry students, prior students that had completed a 12 month work placement and learners that had progressed directly from level 5. Two weeks lessons at the commence of the unit and one at week 5 were introduced into the delivery (6 hours) which were devoted to ensuring the learners understood the assessment, the links with the other units, the teaching and learning strategies (active learning), the skill development including the benefits in terms of employability and finally the value of effective reflection. Week one described in detail the project and skills required to complete the assessment task. The teams had already been split for the design unit so they were asked to reform to read the assessment, discuss the requirements in relation to their selected sport, identify any knowledge gaps and formulate a research plan to enable them to fulfil the outcome. The second week focused on creating an awareness of active learning and metacognitive strategies. Within this session reflective activities both individual and team based were introduced. In addition the previous weeks brainstorming exercises were condensed and evaluated with the full cohort to enable all the groups to benefit from their peers approach to planning. Week 5 provided an opportunity for a learning support colleague to conduct a lecture based on managing group dynamics and effective project management. This was particularly useful since the learners had engaged with 4 weeks of active learning so they had a personal experience to reflect on. The guest lecturers with subject specialists occurred on weeks 3, 4, 6, and 7 (Table 6.1) each lasting an hour with opportunities for questions. At the end of each week session a 30 minute period was provided to enable the groups to meet and re-formulate their research plans in relation to the input received from the guest lecture (tutor support was available during this period). Assignment guidance was provided at week 8. However, during the activities it became evident that the PBL approaches between the groups was leaning towards two different research techniques, therefore an extra session was introduced at week 4 to address this. Assessment was in the form of a group portfolio containing a series of individual 1500 word critical reports demonstrating the ability to source information on novel, emerging and new technologies in relation to their final design. Each team member included a final sketch taken from their design work which made up a team range consisting of various elements (travel garments, training wear, event kit, undergarments, warming up kit, tracksuit, and podium wear etc). Further to this the group synthesised the individual range components to create a comprehensive introduction and conclusion. The design unit assessment was completed at the same point and Phase 1 ended. The second phase involved two elements the group producing a series of conference style posters to communicate the technologies utilised with their garment design; and secondly the selection of an outfit which was to be developed into a prototype package (working drawing, technical specification & material selection) intended to be manufactured by a professional seamstress. The group portfolio and conference style poster enabled the learners to fulfil the first two unit learning objectives (paragraph 6.3 [a&b]).

6.3.2 Spring term delivery

The second part of the assessment (phase three of the project) focused on the evaluation of a selection of technologies and the effective communication of these in relation to the functional sports range. The assessment was a 30 minute team presentation in which PowerPoint may be used to communicate the findings. In addition 10 minutes of questions related to both subject knowledge and skill development where built into the assessment criteria. This part of the project was intended to be reflective, initially in relation to the advantages/disadvantages of each technology, and later in relation to the product development process for the selected garment. Four technologies were incorporated each over a period of 2 weeks (4 hours) a) 3-D scanning and body morphology, b) material science and FAST objective testing, c) seam engineering and single ply cutting technology and finally d) 3-D garment modelling (utilising V-stitcher). The twelve PDT were split to form four classes (each of approximately 20 students) which rotated around the four selective technologies (Figure 6.2). A team teaching approach was utilised to conduct this efficiently. This approach took a great deal of planning since each group began at a different location on the cycle (Figure 6.2) therefore all the materials and procedures required pretesting to ensure they would work independent of the other activities. It was up to the learners to make the integration between the technologies and evaluate the pros and cons. At the beginning of the unit and again half way through the team teaching sessions the learners where provided with specific guidance in relation to the assessed outcome. At the end of the 8 weeks of technology sessions an external guest lecturer from a UK company synthesised the technology in relation to the global market focusing specifically on sportswear. The final two weeks were devoted to providing tutorials to each of the 12 PDT. Due to the intensity of the technology sessions the PDT had not been allocated any class time to meet. Therefore, the supportive structure which had been evident throughout the autumn term had reduced significantly during the spring term since individuals had developed a higher level of autonomy and had become largely self directing.

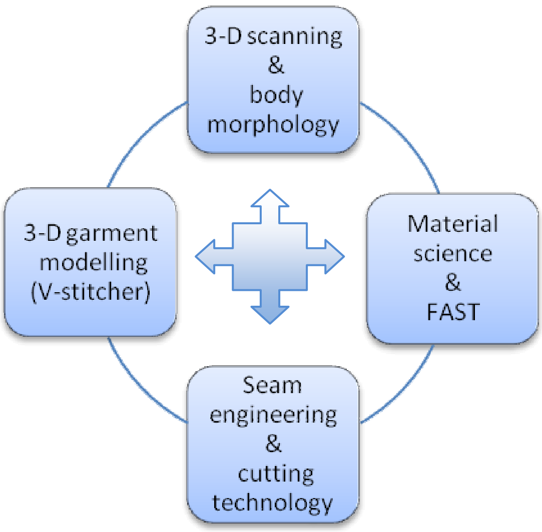

Figure 6.2
Integration of the four technologies

6.6 Evaluation

The evaluation strategy for the unit included five approaches; the practitioner journal, learner formative feedback, learner skills audit, attendance records and assessment grade. The practitioner journal was based upon observations during the first 6 weeks of active learning establishing common metacognitive strategies within the PBL. Learner feedback was obtained at week 24 via a formative feedback questionnaire which focused directly on issues related to learning, teaching and general aspects of the unit. The questionnaire was modified from an existing format and used a Likert scale response. The feedback sheets were analysed using SPSS software. Most of the questionnaire focused around closed questions, asking the respondent to agree, disagree on a scale of 6 (strongly agree, agree, neutral, disagree, strongly disagree and not applicable), However, some questions were open ended and were coded to enable common themes to be established. Each learner on the week prior to the presentations was requested to complete a skills audit form based on the 6 categories of generic skills as described by the QAA (Table 2.1). Attendance was taken weekly during the activities and cross referenced with a manual head count. Assessment was recorded and plotted against attendance to assess the correlation. The evaluation is intended to be compared to the discussions within the work of Kimmons & Spuruiell (2005) and Power (2010)

7.0 Conclusion

In order to devise the most suitable teaching and learning strategy for a new unit various andragogy literatures was consulted. It became apparent though evaluation that four statements provided the key to unlock the industry ready graduates the global apparel industry desires.

- The development of technical competencies
- The expansion of life skills for a globalised knowledge economy
- The advancement of high order cognitive skills
- The understanding of metacognitive strategies

This paper presents the curriculum and teaching and learning strategies that were devised under the unit heading Technologies for Specific Product Development. This was based around the principles of active learning including elements of PBL to promote critical thinking, analytical and self development skills. There was a strong focus on; technology (source novel, emerging and new technologies), the development of higher order cognitive skills (analysis, synthesis, and evaluate), and personal skill development (based on the generic knowledge and understanding, attributes and skills listed in the QAA (2008) subject benchmarking statements). To enable such a novel approach to teaching and learning to be adopted, heavy investment is required in terms of a) staff support, b) physical resources (rooming) c) material resources, d) innovative technology and equipment and e) CAD/CAM software. The three principles of cognitive development (learning environment, interaction with peers, and awareness of metacognition) were given maximum consideration at planning stage. The amount of time and effort required to introduce active learning strategies in a large cohort should not be underestimated. However, if the findings from other studies are transferable the students learning experience should improve when utilising this approach (Hawley, 2005; Power 2007; Power, 2010). In order to determine the success of the units teaching and learning strategy five approaches to evaluation have been described. It is the intention to present the finding in a supplementary publication.

8.0 References

Atherton, J. S. (2009) *Learning and Teaching; Bloom's taxonomy* Available from: <http://www.learningandteaching.info/learning/bloomtax.htm> [Accessed: Feb 2010]

BIS (Nov, 2009) Higher Ambitions (Government blueprint Paper). Department for Business, Innovation and Skills. Available from: <http://www.bis.gov.uk>.

BIS a (Nov 2009) Skills for Growth. Department for Business, Innovation and Skills. Available from: <http://www.bis.gov.uk/policies/skills-for-growth> [accessed Feb 2010].

BIS (Feb, 2010) Annual Innovation Report 2009. Department for Business, Innovation and Skills. Available from: <http://www.bis.gov.uk/annual-innovation-report-2009>.

Bloom, B. S. eds (1956) Taxonomy of Educational Objectives, the classification of educational goals – Handbook I: Cognitive Domain. New York: McKay.

Cannon, R. & Newble, D. (2000) A handbook for teachers in universities and colleges 4th Ed. London: Kogan Page.

Carpenter, J. M. & Fairhurst, A. E. (2005) Delivering Quality and Value in the Classroom: The Use of Problem-based Learning in Retail Merchandising Courses. Clothing and Textile Research Journal. 23(4) 257-265.

Cornoldi, C. (1998) The Impact of Metacognition Reflection on Cognitive Control. In: Mazzoni, G. & Nelson, T. eds Metacognitive and cognitive neuropsychology. Mahwah: NJ: Erlbaum.

De Gallow, D. (2000) What is Problem-based Learning? University of California. http://www.pbl.uci.edu/whatispbl.html [accessed Feb 2010].

DeLong, M., Hegland, J. & Nelson, N. (1997) Encouraging Critical Thinking in the Classroom: an Example from Aesthetics. Clothing and Textile Research Journal. 15(2) 86-95.

Dickerson, K. G. (1999) Textiles and Apparel in the Global Economy. US: Prentice Hall.

Downing, K. (2001) Information Technology, Education and Healthcare: Constructivism in the 21st Century. Educational Studies. 27(3) 299-235.

Downing, K. et al (2007) Metacognitive Development and Moving away. Educational Studies. 33(1) 1-13.

Downing, K. et al (2009) Problem-based Learning and the Development of Metacognition. Higher Education. (57) 609-621.

Driscoll, M. P. (1994) Psychology of learning for instruction. Needham Heights, MA, Allyn & Bacon.

Eckman, M. & Frey, D. K. (2005) Using WebCT NAFS Program to Promote Analytical Thinking and Global Awareness Competencies Through a Team Approach. Clothing and Textile Research Journal. 23(4) 278-289.

Fiore, A. M., Kadolph, S. J. & Ogle, J. P. (2005) Promoting Critical thinking in Product Development: connections Between textile Science and consumers' Aesthetic value. Clothing and Textile Research Journal. 23(4) 229-237.

Flavell, J. H. (1999) Cognitive Development: Children's Knowledge About the Mind . Annual Review of Psychology. (50) 21-45.

Goldstein, Y. (2009) Virtual Prototyping: From Concept to 3-D Design and Prototyping in Hours, In Walter, L et al eds (2009) Transforming Clothing Production into a Demand-driven, Knowledge-based, High-tech Industry. London: Springer.

Hawley, J. M. (2005) Border Crossing: Active and Deep Learning in a Large Global Consumption Class. Clothing and Textile Research Journal. 23(4) 307-321.

Hmelo, C. E. et al. (1997) A Theory Driven Approach to Assessing the Cognitive Effects of PBL. Instructional Science. (25) 387-408.

Jacob, J. (2007) Surveying the Present and an Imagined Future: The Quest for a Bright Future in the Textiles and Apparel Professions. Clothing and Textile Research Journal. 25(4) 349-374.

Jones, R. M. (2002) The Apparel Industry. UK: Blackwell Science

Kadoloph, S. J. (2005) Equipment Experts: Enhancing Student Learning in Textile Science. Clothing and Textile Research Journal. 23(4) 368-374.

Kelly, A. V. (2004) The curriculum theory and practice 5th Ed. London: Sage publications.

Kember, D. (2000) Action Learning and Action Research. London: Kogan Page Limited.

Kimmons, J. V. & Spruiell, P. R. (2005) Using Problem-based Learning in a Multidisciplinary Setting. Clothing and Textile Research Journal. 23(4) 385-395.

Knowles, M. S. (1980) The Modern Practice of adult Education, from Pedagogy to Andragogy. New York: Adult Education Company.

Laughlin, J. & Kean, R. C. (1995) Assessment of Textiles and Clothing Academic Programs in the US. Clothing and Textile Research Journal. 13(3) 184-199.

Marchant, G. J. (1989) Meta-teaching: A Metaphor for Reflective Teaching. Education. 109(4) 487-489.

Mayes, T. (1998) Teaching, Technology and Talk. The Psychologist. 11(8) 375-377

McGill, I. & Beaty, L. (2001) Action Learning 2nd Ed. London: Kogan Page.

Neary, M. (2002) Curriculum Studies in Post-compulsory and Adult Education. UK: Nelson Thornes Ltd.

O'Neal, G. S. (2007) Continents, Cultures, curriculum: some Thoughts on the future of the profession. Clothing and Textile Research Journal. 25(4) 375-379.

Piaget, J. (1977) The Development of Thought: Equilibrium of Cognitive Structures. (New York, Viking Press).

Power, E. J. (2007) An examination into textile education by active research *Conference proceedings: 85th Textile Institute Annual World Conference*. (UK, Textile Institute).

Power, E. J. (July 2010) Examination of issues effecting the teaching and learning of large cohorts within practical based subjects. International Journal of Fashion Design, Technology and Education. 3 (2) 55-66.

QAA (2008) Subject benchmark statements (Art and Design). The Quality assurance agency for Higher Education 2008.

Russ, R. & Dickenson, J. (1999) Collaborative Design: "Forming, Storming and Norming". Journal of Interior Design. 25(2) 52-58.

Schroeder, C. (1993) New Students – new Learning styles. Change. 21-26

Von Wright, J. (1992) Reflections on Reflection. Learning and Instruction. 2(1) 59-68.

Walter, L et al eds (2009) Transforming Clothing Production into a Demand-driven, Knowledge-based, High-tech Industry. London: Springer.

ACKNOWLEDGEMENTS

The Author would like to thank all academic, technical and learning support colleagues who participated in, and supported the development of this unit. Without the assistance of so many this unit would not have been possible, in addition a special thanks should be expressed to the department for enabling the technical resources, staff and time tabling to be favourably arranged.