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The development of a resource tool for the revitalisation and enhancement of sewing skills and expertise

Abstract

Prolonged observations of fashion students highlighted a lack of understanding of garment construction quality, technical knowledge and skills, timescale boundaries, and a lack of confidence to experiment with construction techniques; it was the realisation of these issues which initiated a study to revitalise and enhance sewing skill capability through a purposely designed resource tool. While originally developed to be used by fashion design students the resource tool when fully developed would also be useful for craft dressmakers to develop and enhance their skills and expertise. In the fashion student context an extensive literature review substantiated the observed sewing skills which was also verified by further industry personnel through interviews. While the salient points from the literature review and interviews are given the main purpose of this paper is to outline the development stages of the proposed resource tool which was designed to serve as an aid to revitalise and enhance garment construction knowledge, skills and expertise. The resource samples were inspired by clothing collections held in two UK archives thus offering an opportunity to revitalise some of the more complex construction techniques that are no longer used in modern mainstream fashion. The usefulness of the resource tool is also given along with future developments to improve the system.

Introduction

In the UK there is a general assumption that fashion students will have basic sewing skills and knowledge gained from previous study or experience, on which to develop design skills and further technical skills that will ensure graduates are suitably prepared for a career in the fashion and clothing industry. However, it is increasingly evident from industry personnel and educators, supported by academic literature and government and commercial reports, that this is rarely the case. Rather than fostering intermediate sewing skills in the first year of study in preparation for

further advanced techniques later in the programme, fashion educators are finding it necessary for students to have to learn the basics. From the UK industry perspective, few fashion graduates are now equipped with the necessary skills and knowledge that the industry demands, and in some instances, a lack of motivation to explore more advanced sewing techniques has been observed in the classroom environment. It is considered that the identified skills gap, or lack of sewing skills acquisition and expertise is likely to be a result of changes to school education priorities and to changes in societal attitudes that have essentially demeaned the value of sewing skills, relegating the activity of dressmaking to lower-class domesticity orders. However, basic dressmaking skills are at the forefront of garment construction and garment design for commerce. In addition, the craft of dressmaking purely as a hobby is also well deserving of consideration in the context of revitalising sewing skills, knowledge and expertise. While there is still an interest in the craft and particularly in the UK it is now well supported by popular TV programmes, resources for developing and enhancing the skills at high levels of expertise are limited. From an industrial perspective the lack of sewing skills is considered to be more detrimental to the quality of garments and to the competitive edge that fashion and clothing wear companies strives to capitalise on. This paper is based on a larger study that endeavours to address the identified problem state through the development of a resource tool to revitalise and enhance sewing skills. The resource tool comprises seam, pleat and fastening types designed to provide basic sewing techniques in a manner that engages its users to then experiment with more advanced applications. The tool has been developed and tested in the Higher Education (HE) context both for convenience and to purposely address the problem specifically for the industry sector however, the tool is also considered to be useful for individuals with an interest in the dressmaking craft, thus extending the revitalisation of sewing skills beyond academia.

Project rationale

Through observations over time, the lack of understanding garment construction quality for different market sectors and the inability to identify the appropriate manufacturing and finishing techniques for set budgets have been identified in the classroom environment as crucial skills that are currently lacking in this generation of fashion design students and consequently, graduates. Design and cut skills have been seen to have taking precedence and construction methods explored through sampling, design development and garment realisation are often perceived as been uninspiring and rudimentary with a lack in experimental enquiry. Some students seem to lack confidence or are otherwise reluctant to explore innovative techniques in construction. For many students garment construction can often be viewed as a necessary yet uncreative means to an end for design solutions. This raises questions around the lack of appeal in exploring the technical side of construction. In addition, to deliver a collection on time relies on knowledge, skills and dexterity to execute appropriate construction techniques. It is evident that many students rarely enjoy sewing because of the investment of time needed to master the techniques. The recognition of these issues led to an extensive literature review and primary research in order to develop an engaging resource tool for sewing skills acquisition.

The skills gap

Romeo & Lee (2013: 13) found garment construction skills to be one of the major concerns from fashion industry personnel, which were cited as one of the most frequently lacking skill areas for creative designers. Poor knowledge of seams and construction was suggested to be a leading factor in preventing designers from translating creative ideas into a garment that can be manufactured. Jamie Petrie, manager of the fashion and textiles sector at skills agency Skillset, suggests that there is an oversupply of design graduates without the technical, operations and manufacturing skills to meet the supply and demand of the clothing industry (Drapers, 2011)

emphasising that design creativity alone leaves students ill-equipped to deal with the transition into work where they need to understand how to put orders into production.

Hayes et al. (2012; 48) make specific distinctions between the designer and technologist suggesting that a designer has ‘the flair to innovate and create new product designs’ while it is the production technologist who maintains ‘the design integrity whilst being a realist in developing the design into mass production’. Swift and Brown’s (2003: 827) paper on the implementation strategies for design and manufacture discusses the outcome of a lack of overlapping expertise through a notable gap in knowledge between design knowledge and manufacturing skill in exploring issues surrounding product over-design. They found that 50 per cent of product development was wasted through the rework of over-complex design, which often amassed substantial financial implications. They propose clearer communication of manufacturing knowledge during the early stages of design would allow problems of over-complexity to be resolved more efficiently before the manufacturing stage begins. Furthermore, O’Driscol (2002: 318) states that there are many occasions in the manufacturing sector when production processes were poorly performed as a result of insufficient understanding of production capabilities linked to design requirements. O’Droiscol suggests that the information regarding design details into manufacturing processes is often inadequately explained and recommended that the designer and manufacturer should have some significant overlap in knowledge comprising of design aesthetic and technical competency to counteract the insufficiencies in poorly performed production processes.

Decline in needlecraft in schools

Frayling (2011:11 cited in Houghton, N., 2009) discusses considerable anecdotal evidence that young people now studying higher education art and design courses are demanding more hands-on activities, which could stem from a decline in needlecraft experience during earlier education stages. The decline of needlecraft in secondary education is suggested as a

significant factor relating to the skill decline, which may in part be brought about by today's throw-away culture (Norum 2008: 125).

Norum (2008) proposed current clothing consumption practices as being accountable in the lack of sewing skills of millennial's. Results from Norum's study, which examined the clothing maintenance skills and practices of millenials, indicated that there was little evidence of repair work being undertaken as a normal and regular activity. It was also established that most repair work carried out involved minor skilled tasks such as 'sewing on buttons and fixing hems'. The survey indicated that many participants did not have the necessary skills to repair clothes and that an overall decline in repair skills was in part due to a decline in teaching the skills in schools. It is also recognised that manual skills of this nature demand time and patience to master. The 2013 Education Manifesto for Craft and Making found that the take-up of craft-related GCSEs dropped by 25% between 2007-2013 due to 'concern among parents and children…that arts subjects are hard work and time consuming', with the potential to detract from academic performance in other subjects (Craft Council 2013: 5).

In line with the production of a sewing skills resource tool, the value of sewing from an academic perspective has been considered. The significance of teaching sewing skills on fashion design courses seems to be downplayed from certain academic viewpoints. Beard and Slocum (2005: 299) acknowledge Buckland's (2000) paper on the history of sewing, which states its importance as controversial yet some sewing competency is recognised as enhancing students' understanding of garment structure to execute projects with informed judgement. McRobbie (1998: 57) also discusses a marginalisation and downgrading of the practical skills involved in making clothing, suggesting fashion as a subject remaining apprehensive to acknowledge the value of technical skills. There is also an interesting historical viewpoint around the successful status of fashion as a creative artistic subject wanting to disassociate itself from the menial skills of dressmaking. This seems to emphasize the division of labour between design and sewing.

Methodology and major findings

Interviews

The development stage of the resource tool was initially informed by an extensive literature review, the most salient points of which are discussed in the previous section. Interviews were conducted with two local SME (small to medium enterprise) manufacturers to develop a further understanding of the perceived skills gap debate. The interview questions were themed around initial literature review findings.

Interview Findings

The semi-structured interviews focused on the problems encountered whilst working with undergraduates and recent graduates during the manufacturing of collection garments. This covered: The skill gap between designers and industry standards, construction knowledge and awareness, the value of manual skills and production roles, garment construction/finishing methods and factors in lessening the skills gap. The major issues identified were:

1) Generally limited technical knowledge including pattern cutting and construction awareness and ineffective communication skills to realise garments appropriately which affects the flow of garment realisation, costing, time allocation and the depth of involvement required from the company. Not able to produce adequate pattern work or technical specification packs to support garment manufacture which contributes to higher costs and delays on production.
2) Unrealistic expectations and viability of garment design - little understanding of the qualities of certain fabrics, construction methods or finishes which resulted in the re-working of designs and patterns incurring additional cost.
3) Lack of financial knowledge and awareness (costing) - rated on a par with lacking technical knowledge. A concerning point surrounding the financial implications issue

appeared to be based on design intervention due to undergraduates and new graduate designers having poor knowledge of construction.

In discussing ways to combat the skills gap and recommendations for improvements, there was a positive response to the idea of exposing undergraduates to further techniques through the aid of a resources tool. It was also affirmed that sewing knowledge considerably enhances design ability.

Pilot Study and focus group

A pilot study was conducted where a group of second year students were observed using a small selection of purposely created stitch and seam type resources. Students were required to produce a series of fabric samples using creative techniques and processes demonstrating their ability to recognise specialist manufacture techniques and fabric and stitch types. During the pilot study, observations focused around the implementation of the resources to better understand their effectiveness and notes were made in situ. The field notes documented student sewing skills, and photography was used a means to record the observations. During the sessions an academic member of staff witnessed the observations to acknowledge the validity of the field notes. These initial observations outlined the effectiveness of the resources, and identified areas for improvements. The pilot study samples were: French seams, butt seam, lapped seams, Hong Kong finish and other binding, rouleau loops and spaghetti straps, faggoting and decorative finishes. A focus group then followed with four of the students to gain constructive feedback to inform the design of resources for the main experiment, for which a further range of fabric resources were developed using inspiration from two clothing archives and guidance from the interviews, the pilot study and the focus group.

Issues from the focus group:

While the students agreed that they would not have liked a more extensive range of resources and techniques as they preferred to use the resources as a stimulus for developing their own ideas, they did however suggest that a wide range of unusual and difficult fabrics to sample would have allowed for clear recognition of the types of production techniques relevant for different fabrics and materials. They also valued hanging samples on a rail as the best format in order to appreciate and handle the resource tool samples during the sessions. The students confirmed that in the first year of study they felt they had very little understanding and appreciation for manufacturing, feeling that amendments made to designs by staff disregarded aspects of their creativity. Building on the confidence gained after teaching and practicing garment manufacture techniques, the undergraduates suggested that they were able to recognise the flaws of their designs more easily and could better understand the feedback from staff which enabled them to consider the manufacture stages of their designs more comprehensively. They noted that it was pointless designing something that they could not visualise being made.

The main experiment

Fifty six students were then observed creating their sewing samples using the revised range of fabric- and stitch-type resources on a weekly basis for three consecutive weeks for the main experiment. In week one the students created seams, finishing and hem types; in week two pleats, folds and gather types and in week three fastening technique types. Two tests were developed per weekly session. The first test was conducted before the resources were introduced and the second was conducted after resources were implemented, this allowed the observer to witness variations of student sampling before and after the resource implementation to appreciate any comparisons. In the first test each week, students were asked to create three examples around the themed areas using calico and other trims. The samples were collected for assessment purposes. Students were then introduced to the fabric resources which were

relevant to each week's session topic. Time was taken to discuss each technique to the student group then during the second test students were asked to produce an additional three examples of the weeks' topic using the resources as inspiration. Both sets of samples were then collected and assessed comparatively using a scale of 1 (poor) to 5 (excellent) for the following criteria: 1) The quality of the samples produced, 2) The control and precision of the sewing, 3) The manipulation of the materials, 4) Dexterity in sample development, 5) The functionality of the samples, 6) Inventiveness of techniques explored, 7) The appropriateness of the technique for the fabric, 8) The sophistication of the technique, 9) Creativity of the approach and 10) The aesthetic value of the sample. The experiments were controlled in order to ensure that the testing was fair and equal in each setting. Students were not able to use electronic devices to access the internet and were only shown the fabric resources for guidance after the first set of samples had been completed and collected. At the end of each session students were issued questionnaires, three in total over the three sessions. The questions were linked to the featured weekly techniques to ascertain their thoughts and opinions on the implementation of the resource tool.

The development of the resources tool

This section presents the results of the main sewing experiment and the most important findings from the primary research methods that were used to inform the design of the resource tool. The 33 resources developed by the students during the main experiment were categorised into high, medium or low skill levels and also sub-categorised into two distinct groups - creative techniques and technical techniques. Samples in the creative range required students to use independent interpretation, while those in the technical sample range required students to remember previously taught techniques to perform stages in logical sequences. Low skill techniques in the creative samples include: knotting, knotting 2, faggoting /dissolvable, and pleating. Low skill techniques in the technical samples include: overlocking, 1cm open seam

top-stitched, hand sewn hem and pin hem. Medium skill techniques in the creative samples include: butt seam with strip, butt seam, vinyl hem, ridgeline hem and elastic seam edge. Medium skills techniques in the technical samples include: French seam inserted, French seam, lapped seam, run and fell seam, elastic seam overlocking, gathering lapped seam, alternative to darts and exposed tape zip fastening. The high skills techniques in the creative samples include: Hong Kong binding, French seam adapted, gathering 1, gathering 2 and drawstring. The high skills techniques in the technical samples include: double bindings, single binding, double binding hem, invisible zip, bagged-out zip with exposed teeth, rouleau loop fastening and continuous strip vent opening.

Main experiment findings from the observations

In the main experiment there were several issues arising from observations with the student group. Most significant, was the lack of independence to explore techniques without the aid of the Internet or fabric resources for inspiration. This highlighted the importance of the resources as a positive teaching aid, yet also suggested that students were not able to recall from memory the stages of techniques which had been previously demonstrated in the previous year of the course. This was a really interesting factor which allowed for further exploration into the reasons why certain techniques were more or less appealing during the three weeks of testing which is discussed later in the questionnaire findings section.

A large percentage of the student group did not understand some of the really basic seam classifications, such as variations of the same seam type. For example during the testing many students did not realise that a curved 1cm open seam (Image 1) was the same seam type as a straight 1cm open seam (Image 2).

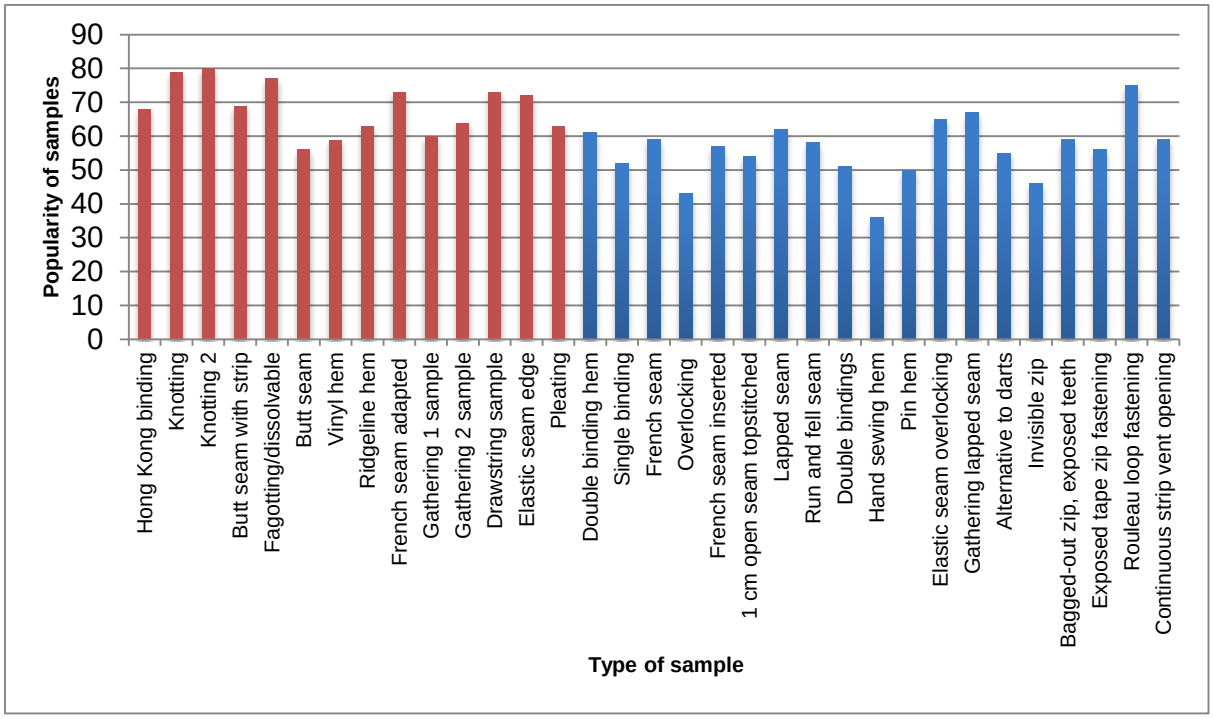
Image 1: Curved 1cm open seam

Image 2: Straight 1cm open seam

Questionnaire findings

The series of questionnaires issued after each session gave students the opportunity to evaluate the techniques implemented in the three sessions where each sample was analysed for its potential effectiveness and engagement. The results of the popularity of each technique are shown in figure 1, where the red bars indicate the creative sample range and the blue bars indicate the technical sample range of the 33 techniques over the three sessions.

Figure 1: Popularity of resources implemented over weeks 1, 2 & 3 of observations

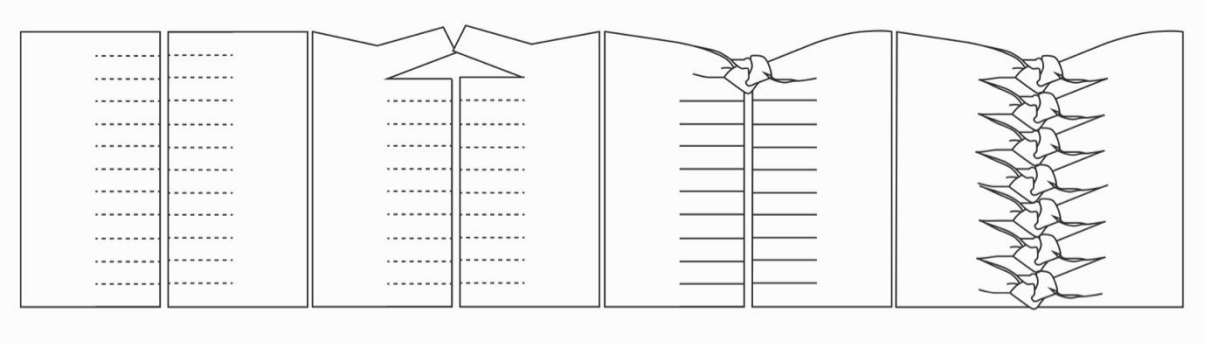


The results in figure 1 show the most popular techniques amongst the range of 33 samples appeared to generally be from the creative technique group, in particular, the knotting samples. These particular samples (Images 3 & 4) were adapted to a low level skill for the experiment. Of the two versions, the bias cut knotting sample was the most engaging technique, perhaps due to the gingham fabric choice over calico. Twelve of the seventeen students stated they had replicated this technique in some form during the experiment. The production of this technique involves very minimal skill and equipment in terms of sewing only requiring scissors to cut and snip into fabric and to join the strands together with a series of hand-tied knots, the technique therefore could be achieved very easily with minimal guidance or memory to recall the stages of construction; the knotting instruction diagram is shown below in figure 2.

Image 3: Knotting sample 1 straight of grain

Image 4: Knotting sample 2 bias cut

Figure 2: Knotting instruction diagram



From the results it is fair to assume that in general the creative samples were more popular and engaging for students, perhaps due to the aesthetic values and appearance and the ease in production of these techniques compared to the technical range as they were all relatively easy to produce independently.

Another popular technique was the faggoting dissolvable sample (image 5) was again adapted to a lower skilled creative technique. Similar to the knotting and gathering samples, this technique required an emphasis on more creative methods of stitching and not necessarily memory to recall stages of a process. This particular sample required cold-water dissolvable film and stitching to link the fabrics together.

Image 5: Dissolvable film faggoting sample

Image 8: Rouleau loop fastening

From the results of this experiment there appears to be a pattern to suggest that the more creative techniques, which required individual interpretation instead of recalling stages of a process were the most popular for students to recreate. This would suggest that in order for students to engage with more difficult technical samples there needs to be some kind of creative or aesthetical link to engage them in the process. Interestingly though, the rouleau loops fastening from the technical sample group (image 6) was rated highly by the students (third highest) yet it was the second most skilled technique in the resource tool. However, only eight students recreated this technique, which may have been due to the difficulty in achieving it

accurately, which is similar to the findings for the binding samples where bias fabric lengths need to be pre-cut and the recall the stages of construction were necessary.

Further findings indicate that students generally avoided difficult tasks such as the cut and bag-through stage of the bias-cut strips to create the rouleau loops, which was effectively one of the most difficult stages of construction for this sample. The students tended towards easier techniques such as using a variety of adaptations such as stay tapes, trims and types of elastic. While such actions demonstrate an unwillingness or a lack of understanding of using the resources to create considered sampling reflective to the resources shown, it does however demonstrate creative initiative and independence. Avoiding the difficult stages of some sample techniques however outweighed the effectiveness of the aim of the resource tool, as students did not fully engage with the essential stages required to recreate some of the fastening types. Linked to the idea of students preferring the creativity in sampling as opposed to the more technically skilled versions, the binding samples were rated as the highest skilled of the resources. This again supports the idea of students preferring the creative skills as they rated this technique rather unfavourably. This suggested that the difficulty in achieving the technique was off-putting as only six of the seventeen students replicated this finish, and the samples created in most of the student interpretations were poor in terms of accuracy possibly due to the importance of recall for certain stages of construction, or the fact that further cutting of bias binding would be required seems to indicate that students were in some way unwilling to use their own initiative to create adequate versions.

Of the 33 techniques introduced over the three sessions there were some other interesting assessments. Students investigated ruching and gathering fabric with elastic trim, and results from questionnaire findings demonstrated these samples as highly engaging. Like the knotting samples discussed above, the elastic and gathering samples were intended as moderately

simple techniques and produced quick, adjustable aesthetically creative finishes. During the observations, the majority of students did not understand how to use elastic effectively. The simple, basic process of stretching elastic and machine stitching it securely onto fabric was surprisingly challenging for the majority of students to replicate which was noticeable in the assessment of students' samples. The least favourable examples were the hand-sewn hem, overlocking types and the insertion of an invisible zip. These techniques all required some type of advanced technical skill often with little room for innovation or error in the finish. The darts and pleats sample was also a technique requiring a good deal of skill to create. This sample was included to help students to understand the alternative uses of darts such as recognising that volume could be transferred into panels to eliminate fabric bulk, or that box pleats or other interesting folding techniques could be used instead of darts to enhance the look and appeal of garments. Students generally do not consider that a huge dart could be modified to a panel line, or presented as a type of pleat instead. The technique received a low rating by the students possibly because it required students to be fully aware of the use of darts in clothing prior to the sampling. One of the least interesting techniques for students was the invisible concealed zip. This was one of the most technical samples to achieve out of the full range of samples and it is not often that students can achieve a professional finish to this zip type without the assistance of technical support. With this said, the memory involved in recalling stages of the zip technique could be the main reason for the low rating. There is a pattern to suggest that use of memory and skill in recalling stages of a process, such as the zip insertion, binding, overlocking and pin hems relate to the less popular choices. At least for these students, the more creative easy to interpret samples such as knotting and faggoting appear to be the most popular samples.

Significance of resources

As students were asked to gauge their sewing ability before and after the experiments over the three sessions, there was a noted increase in ability levels from the intermediate to advanced

bands only for a minority of students. However, nine of the seventeen students believed they were already operating at an advanced sewing ability level before the resource implementation. Two students genuinely felt that their sewing abilities had been further advanced as a result of the resources. From the outset of these results it was surprising to reveal that a large percentage of the group already believed that their sewing abilities were at an advanced level at this stage of the course. Being aware of the general standard of sewing work produced at a second year intermediate level, it was felt that this was not the case and therefore it was considered if students were fully aware of the definitions of each sewing category. It would appear that the simplistic categorisations of the four areas; including basic, intermediate, advanced and expert classifications might have needed to be more descriptive to ensure students were able to categorise themselves accordingly, as at the onset of the experiment the majority of second year students would more realistically be at an intermediate or basic level of ability. It was therefore interesting to realise the expectations of some students' categorisations to be so advanced. This suggests that perhaps the length of time in which students were given to experiment with the sampling was too limited to make a significant impact on their learning. In reviewing this analysis of sewing ability levels it would seem that there is room for further development in the style and detail of resources, as well as the timescales and complexity of sampling which could allow for more significant results in further research development around this theme. From the results the researcher had also anticipated that more students would have progressed on from a lower to higher banding after the sampling implementation, yet this was not the case. When combining the overall marks from the seventeen students over three weeks, in the final week of testing there was quite a large decline of overall marks in terms of quality of sampling. It appears that as the techniques in the sessions became more advanced, the results for each student were generally lower. In week 1 the collective results from the seventeen assessed student samples were considerably higher in comparison to weeks 2 and 3. There are perhaps a few reasons for this; one is that students might have been more engaged in the

testing as this was the first of three sessions of experimentation, and therefore they might have found the resources in this first session to be more successful in aiding their development, or perhaps students felt most confident with this range of samples because they were all based around seam adaptations, which are the basic and fundamental foundations when learning how to sew. It is worthwhile to note that the dramatic change in assessment results throughout weeks 1, 2 and 3 of testing highlights the overall effectiveness of the range of samples introduced in each session. The results suggest that if further developments to the resource implementation were made, additional samples would need to be developed in fastening and construction techniques and in the use of darts, tuck and pleats in clothing to allow students to become more confident with these skill areas. In order for this type of sample testing to become more successful as a learning resource in future the timescales for the implementation of the resource tool into teaching and the type and style of the selection of sampling should be considered as in this particular experiment both the timeframe and the resource type, to some extent, were perhaps limited as they did not appear to have a considerable impact on students' advancement of sewing ability. However, this does not render the experiment unsuccessful as there were two students who noted an improvement in their ability as a consequence of the testing. It may have been that these two students were the most honest or that the other students had inadvertently overestimated their earlier capability. For this reason the sample assessments were more valuable for evaluating actual skills improvement.

Conclusion and future development

From observing and assessing students and their work over time it was realised that students and graduates generally lack the sewing skills that are required by the fashion and clothing industry. This initiated a larger-scale study than is reported in this paper. Following a literature review and interviews with industry personnel a resource tool was developed as an aid to revitalise and enhance garment construction knowledge, skills and expertise. The purpose of

this paper is to outline the development of the resource tool. From the sampling results of the main experiment it is clear that there needs to be a strategy to engage students in this method to improve their learning. The timescale for the experiment did not allow for this level of skill acquisition. A major factor for consideration in any potential future development would be in introducing the resources at a much earlier stage. General feedback during observations suggested that the implementation of resources would have been more beneficial to learning if integrated into year one, as the majority of students appreciated the value of resources in contributing to their sewing knowledge. To some extent the researcher was aware of this recommendation before and during this experiment, yet due to limitations in teaching timescales in the first year, which already includes a full scheme of sampling and garment manufacture, there is a very limited timeframe in which this resource implementation could be integrated at that foundation level. It is also apparent through testing that considering the value of each sample would benefit the entirety of the range, to ensure suitability for industry and educational requirements, and engagement for students. In a proposed streamlined set of resources, the exclusion of creative samples such as joining fabrics through alternative means, as with the knotting samples, could be eliminated as results from testing have outlined that these types of samples can be explored independently by students with minimal requirement to work within set boundaries or guidelines. During the testing, the majority of the technical samples were avoided by students because of the ease of use of many creative alternatives, which required more of an artistic interpretation. In effect, the creative samples were easier to experiment with.

Observations from the experiment over the three weeks outlined potential areas for development which could further contribute to student engagement in sewing. The resources could be further developed to feature actual garment prototypes. This could potentially engage students further in understanding how each technique could function within a garment. Although students from the focus group suggested that the standard format for the pilot samples was

successful, being flat and of an A5 standard size, it is believed that integrating the techniques into garment toiles would allow students to better appreciate the three-dimensional aspects and application, for example how seams work on contours, how a fastening might be applied to a centre back, side seam, centre front garment, etc. The resources in effect could become a standard range of bodices, which could feature side back front fastening variations, and the application of a range of technical seams. Future developments of the resources tool should also take into consideration how the tool could be used by a wider audience, in particular the craft dressmaker community who would not necessarily have access to experts to help them to develop, enhance and evaluate the results of their applications. It is envisaged that to fully address the sewing skills gap further experimentation would be required and a method for taking the system beyond academia would be necessary. However, it is considered that a value beginning to this process has been achieved through the development of the resouces tool thus far.

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