

Creative Thinking and Problem Solving Through Cross-Application

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Fast moving changes occurring in the world due to technological advancements and perfected easily accessible communication modes necessitate creative problem solving in this era of information explosion. An easy access to knowledge through information technology of the time has reduced the information retention and thereby learning through personal skills limiting. One of the critical role of technology is to enhance efficiency of the output for any undertaking. Consequently, it prevents its users to understand the whole process fully. Technical experts program the thinking and users spend time in learning the know-how of using the program to meet their need. It takes away from the creative thinking and limits in a way because the user is bound by the technical limits set by its programmer. Any deviation from the program does not allow people to move even one step forward. In other words, what the technocrats can do limits the knowledge creation and use. Such circumstances inhibit an individual from maximizing one's own potential even though the few things that they do by using advanced technology, they can do with perfection.

Problem solving is a critical skill that allows creative thinking to blossom. It forces people to think outside the box. The goal of the problem solving process is to use multidisciplinary approach to solve the given problem. It can be done through utilization of functional, creative and critical skills both inclusively and exclusively. It is similar to the defense mechanisms used to develop consonance with one's own self. One that is similar to problem solving is adaptation as defense mechanism. It allows changing the path of thoughts and actions to make them congruent with the process needed to reach one's goal. Such adaptation takes into consideration individual's capabilities as well as its synchronization with the expectations of the process necessary to achieve the goal. Within the context of textile and apparel, cross application of ideas embraces both creative thinking and problem solving and utilizes critical thinking skills also for both design and merchandising. The purpose of the reported paper is to use cross-application as creative problem solving technique as it applies to apparel design and merchandising and develop a relevant framework that could be used in other disciplines as well.

The reviewed literature revealed that previous scholars in the field used problem solving approach and creative thinking to improve the existing practices for better outcomes than before. Literature review indicated that some scholars used the work of previous researchers or designers, others went to other disciplines to seek new information, others integrated technology in their thinking and practice, and few integrated culture, history and technology to give new forms to old designs and practices. Reviewed literature was broadly categorized and is presented for Creative Thinking and Problem Solving, Problem Solving and Innovation, and Cross Application.

1. Creative Thinking and Problem Solving

Creative thinking allows people to think outside the box and solve problems by using non-conventional techniques. Problem solving is the process of identification of problem, generation of solutions, development of alternative solutions, and implementation of solutions. Creative problem solving refers to thinking of new ways of solving problems with ingenuity and innovation. Even though the clothing selection and designing are of critical importance for any end use, creative thinking and problem solving become significantly crucial for those with special needs (Chowdhary, 2011).

Historically, creativity and problem solving were necessary when one had to deviate from the norm to accommodate for those who did not fit the existing standards. Special needs area is where creativity is needed to solve the problems and enhance the self-esteem of those people who have special clothing needs. Rusk (1972) was the first to recognize the need for functional design for the physically handicapped individuals.

Gurel and Beesen (1975, 79) added a chapter on clothing for special needs in their book, “*clothing designs for handicapped*”. Caddel (1977) developed measuring guidelines for the wheelchair users. She did an excellent job of describing the needs of standing and seated individuals along with pattern alterations necessary to meet those needs. Several other authors also emphasized the needs of those with special clothing needs (Hoffman, 1979; Hotte, 1979; Reich, Otten and Carver, 1979; Atkins, 1980; Newton & Anthony 1980). Mead (1980) published an extension publication to offer creative solutions for those with special needs. The publication covered categories such as limited motion, post-mastectomy individuals, leg brace and crutches users, and visually impaired individuals. Hotte (1982, 1983) extended the area to footwear and foot care. Watkins (1984) introduced functional design process and discussed clothing from special needs within the context of scientific principles of heat exchange and their impact on multiple end-uses. Feather and Wainstock (n.d.) offered creative solutions for women with mastectomies.

Lamb (1991) addressed the issue of learning from the rehabilitation literature and Feather (1991) advocated for mainstreaming the styles to enhance self-esteem and independence of those with special needs. Tondle, Chowdhary and Kline (1993) compiled sources to acquire information and equipment for older people to meet their special needs. Davis (1996) described the design process with exemplary illustrations of utilizing elements of art and principles of design through a six-step process. The process progresses from setting the goal, examining external influences, establishing criteria, making plan, carrying it out and evaluating. Each step needs critical thinking and creative solutions. Chowdhary (2000, 2002, and 2007) developed an annotated bibliography to provide sources and solutions for forty-two special needs categories. Chowdhary (2011) identified cargo pockets, loops in dresses and skirts, slits in garments, elasticized waists, zipper pulls, large buttons, and openings in shoulder area as some examples of mainstreaming styles for those with special needs. To be in style without the seamstresses, it calls for making careful selections from ready to wear markets. For example, cargo pockets that are fashion item for main stream can be used by wheelchair users as functional item who find it hard to use back pockets effectively because of the seated posture used for most of the day. Loops on dresses and skirts, large buttons and zipper pulls help those with limited motion due to arthritis or insufficient development of dexterity in younger years. Slits allow for area expansion and can be useful for those in seated posture and large bulges in the body. Likewise, elasticized waists and openings at the shoulders can be effective with ease of doffing and donning. Use of Velcro also helps those with limited motion. They could be included for both young children and older people. Shoes with added traction work great for soccer as well as snow. From designing perspective, layered clothing is best choice for insulation. Rounded corners prevent garments from getting caught in the wheels for wheelchair users.

Several scholars have identified the need to carefully design special needs apparel for sailing (Bye and Hakala, 2005), use of updated measurements for better fitting and sizing (Schofield and LaBat, 2005; Bye, LaBat & DeLong, 2006; Connell, Ulrich, Brannon, Alexander & Presley, 2006; Griffey and Ashdown, 2006; Salusso, Borowski, Reich & Goldsberry, 2006; Ulrich & Bryant, 2006); Song & Ashdown, 2010), and use of visual imagery Kidd (2006).

Bye and Hakala (2005) used seven-step function design process of Watkins (1995). The literature identified seven functional attributes as abrasion resistant, breathable, comfortable, flexible, lightweight, protective, and strong. However, Bye and Hakala selected thermal insulation, safety, quality, mobility and fit as the critical factors for sailing garments. Thermal insulation was achieved through layering and good visibility was accomplished through the use of reflective and bright colors. Fit focused on women specific needs. Quality was related to durability because of the cost involved with the sailing garment. Functional toileting access was also an added feature of their one-piece garment. The scholars also focused on the aesthetic (gender identity and traditional colors) and expressive (self-esteem) needs. Schofield and LaBat (2005) examined 40 size charts for women's apparel. Twelve measurements (cardinal points) were established for development of bodice front, bodice back and grade rules along with using the anthropometric measurements. The authors recommended the use of twenty-one points that consisted of twelve cardinal points (locations on pattern) and nine body landmarks for best results. The authors suggested use of seven measurements for the grade rules. Schofield and LaBat recommended updating of the existing standards that presumably do not address the need of optimum fit for women.

Bye, LaBat, and DeLong (2006) reported that several systems of taking measurements exist. One with several data points can yield better results. Satisfaction of consumer was noted to be of critical importance. Reportedly, it could be achieved by combining historically used and new methods.

Connell, Ulrich, Brannon, Alexander and Presley (2006) developed a Body Shape Assessment Scale that can be used for assessing body scans. Authors used body build, shape and posture for the whole body analysis. Front and side views were used to develop nine scales to analyze body shape. Six body components were also used. Griffey and Ashdown (2006) used body scanning to create a skier that reportedly fitted well on the wearer's body.

Kidd (2006) asserted the need to use critical thinking skills and use "visual imagery" while designing for those with special needs. Draping was noted to be better technique than flat pattern method. Use of braces and special shoes also had an impact on designing garments. Neckline was also reported to fit differently in moving and still postures. So was true for the armhole area. Low and behold the fitting process was identified as "difficult" (p. 170). Salusso, Borowski, Reich and Goldsberry (2006) refined the old method through Principal Component analysis. The principal component analysis yielded three factors representing thickness, limb length and torso length with factor loadings ranging from .481-.927. The scholars also compared three sizing standards for adult women.

Schofield, Ashdown, Hethorn, LaBat and Salusso (2006) found that fitting the women who were 55 or older was a complex process when tested pants for flatter and fuller seats. Fit was noted to be a problem with existing ready-to-wear. Even though body scanner was noted to offer an opportunity to meet with fit challenges for those over 55, no solid solutions were found.

Ulrich and Bryant (2006) asserted that apparel fit and sizing are a complex phenomenon that is multifaceted. They also emphasized that professionals should share their wisdom with fellow scholars and incorporate new technologies. Song and Ashdown (2010) reported that waist area revealed least consistency for fit interpretation. Most reliable information was obtained for alterations and bust area. Hip area did not yield reliable information for misfits. The study used two methods. There was more agreement for some body parts than other for the chosen methods. The preceding discussion suggests that the cited scholars tried new methods, adapted old methods to design or prepare to design for those individuals who have special needs to allow for better sizing and fit. It is necessary to keep on refining the techniques through creative thinking so that methods could be perfected for better results. Special needs go beyond the challenges that a person may have due to physical handicap. Recreational and competitive activities such as basketball, dancing, figure skating, football, hiking, racecar driving, running and jogging, soccer, skiing, swimming and tennis can also require special clothing features. It is possible that clothing features required for the recreational activity could be different than the competitive one. Former needs comfort more so than the competitive edge.

2. Problem Solving through Innovation

This section includes designers' creations that sought inspirations from culture, history and nature and used various designing and construction techniques for transforming old traditions to modern styles. They integrated information from different cultures and times to create new design forms.

Orzada (2005) used ethnic influences and challenged herself to create contemporary style through use of rectangular pieces by draping and drafting methods. The designer used sage satin, lame, and chiffon for double-breasted strapless dress with obi, bustier and jacket to complete the ensemble. Inspiration for jacket came from Miyake and for other pieces from the Japanese culture. Yofuku is the term used for the western clothing and Wafuku for the Japanese clothing. Kallal (2005) integrated Japanese tradition and appearance enhancement as critical features of a lined wedding dress. The designer had to take into consideration the body size and color of eyes and hair of the client. Cultural hand sewing process was used to create the garment. Quilting technique was used to create patterns with metallic threads and pearls on a silk organza fabric. The creative thinking of the designer was noted by the need to create a quilting technique to duplicate quilted patterns.

Jennings 2007^a integrated lines, shades and textures to enhance the feminine body from using satin back crepe lined dress. Pattern was made by flat pattern method changing darts to seams. Curved lines were used to complement femininity. Jennings (2007^b) used PAD to create a design along with ADOBE Illustrator for a two-piece silk suit. The pattern was digitally printed on the fashion fabric. The intent was to create unique textile design on tailor-made pattern pieces through strategic placement. The process integrated textile design and pattern making. Na (2007) integrated Korean traditions and internationalization to create a modern dress using asymmetric lines and patchwork along with draping and flat pattern techniques. Jennings (2008) recreated a tweed suit using Chanel as an inspiration. The designer mixed fraying, blended inside and outside of the garment, mixed textures, glittery buttons, trimming from ribbons and shirring.

Additionally, she incorporated the couture techniques of Chanel. The lining was quilted and buttonholes were bound. Chains were added to improve drape of the jacket. Schactler's (2010) creative thinking sought inspiration for nature and integrated with draping techniques to create a sleeveless formal gown. Natural eaves were transferred to paper first and then on satin fabric. The scholar integrated inspiration from nature, knowledge of elements of art and principles of design, draping and flat pattern techniques for designing and sewing skills for a contoured garment.

3. Cross-Application

Chowdhary (2002, 2003, 2011) advocated the use of cross application for creative problem solving in apparel design. Cross application could mean wedding of one technique for multiple uses or applying information from one discipline to another. Several such examples are provided in the paper in the later section. Based on the experiential learning and extensive work in the area of clothing for special needs, the concept was introduced in 2002. Focus then was on aesthetic and function in dress as a creative process that analyzes and blends disciplines, ideas and processes to find solutions while designing for those with special clothing needs. In 2003 work, focus was on inclusion and mainstreaming of styles for those with special needs so that cross-application process takes designers away from the linear thinking and promotes contextual thinking along with integrating and critical thinking skills. Davis (1996) mentioned cross-sensory interpretation when she discussed visual design as a product and process.

Examples of Cross Application in Design

Seven examples are provided to demonstrate using cross application of one technique to solve problems of several deviations in the body from the norm or utilizing several techniques to solve one problem.

Example 1

The concept of padding can be used to solve several problems while designing well-fitted clothes for those with special needs (Chowdhary, 2011). A variation of Chowdhary's example is provided in figure 1.

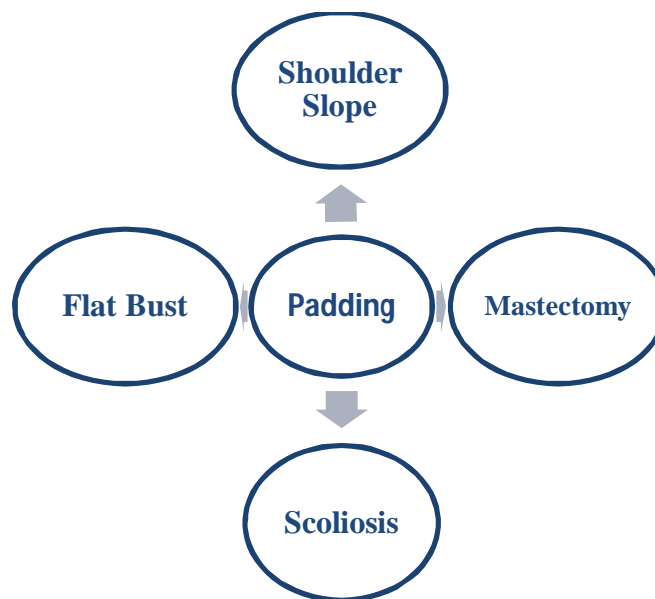


Figure 1: Cross Application of Padding Concept

In this example, one with sloping shoulders can use shoulder pads to create ideal body contour. Women or men with mastectomy could use padding through prosthesis to compensate for the lost body part. Scoliosis can result in flattened back at the shoulder area and flat hip. Adding padding can help those with special need to optimize their body contour. If someone has flat bust, it can be enhanced through padding to reach closer to the ideal expectations.

Example 2

Creating Comfortable Bra for a Mastectomy Survivor and More Mastectomy survivors have issues of body image, femininity and motherhood.

Use of bras as underfashion is affected the most after going through the surgical procedure. Scarred areas can continue to be painful for longer times. Extensions of arms get limited. Therefore, it is difficult to close straps located in the back. Pockets that hold prosthesis, normalize the look. However, narrow straps and bands do not provide the optimized support.

For incorporation of creative thinking process, one needs to think of ramifications of these aspects in garments other than bra. For example, for t-shirts, active wear or lounge one may not like to use prosthesis all the time because it's weight is heavier than the natural breast despite the similarity of the looks. One could use bosom buddies created by pleatung, gathers, or soft contoured structure that provide the body but one does not have to carry the heavy weight. Additionally, such changes can enhance one's body and clothing comfort simultaneously. Likewsie, if we think of the swimwear and other formal wear, the wearer should have higher necklines that can be enhanced either through designing higher necklines or by using camisole in a creative way tomeet the need. Choosing a swimwear from ready-to-wear with high neckline and contured breast can meet the needs of mastectomy survivors through smart selection process. This example should demonstrate creative problem solving through cross-application and critical thinking.

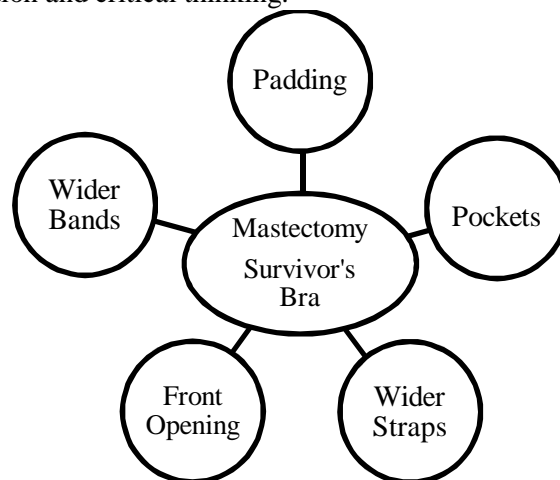


Figure 2: Multiple Needs of one Special Need

Example 3

Requirements of the Aging Body and Corresponding Design Solutions Aging body is associated with limited motion through development of arthritic body, and need for appropriate color choice due to development of brown pigmentation or dilation of arteries and veins that show excessive blueness, and paling skin. Changes in body curvature create additional convexities and concavities that require careful designing or selection of apparel. Due to shortening of the height, thickening of the neck, wrinkling of the skin, and sagging of the breasts require careful selection of design details necessary to make corresponding adjustments in the apparel (Figure 3)

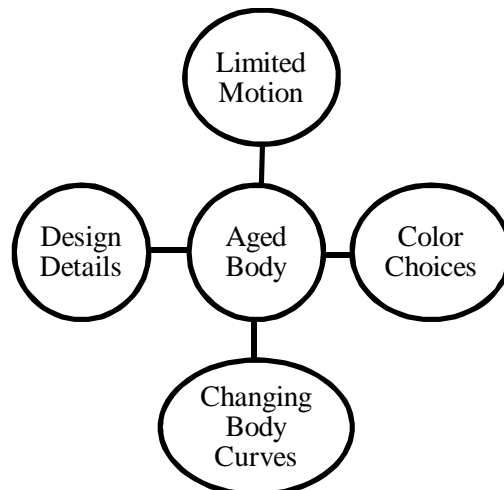


Figure 3: Requirements of the aging body.

One can solve these problems by making creative thoughtful choices while creating or selecting apparel for the aging body. The issue of limited motion can be addressed by using elasticized waists, Velcro as closing option, and assistive fastening tools to enhance both body and clothing comfort. Making proper color choices can prevent accentuation of pale skin (avoid contrasts), blueness from dilated skin (use blues), and brown pigmentation from aging (avoid yellow). The smart choices will avoid drawing attention to the unwanted elements. The issue of changing curvatures can be addressed by using blouses and dresses with the blouson effect that will compensate for the convex or rounded structures. Belts can be added to consume excessive length resulting from hollow or concave structures. Shortening of height can be camouflaged by using length enhancing lines, forms and shapes. Thickening of neck can be countered by use of V necklines and heightened hairdos. Avoid use of high neck or neck defining collars. Wrinkling of the skin can be defied by using textures and prints that blend with the wrinkled skin rather than plain fabrics and flattened textures that may highlight these unwanted features. Sagging of the breast can be camouflaged by using structured contours for under-fashion items and/or fashion apparel or outerwear.

Example 4

Wheelchair Users

This category of users has special needs because individuals on a wheelchair spend more time in a seated than the standing posture. Seated individual has additional convexities and concavities added to the body that call for more length for convexities and less for the concavities of the body. Consequently, while using the mainstream apparel, they experience bunched up folds in some areas and need for additional length in other areas. Both of these issues can result in body discomfort. Excessive folds for prolonged time can result in chafing issues and tightness can result in both body discomfort and aesthetic distortion issues. Using longer back length for jacket than front, and longer back crotch than front draw from the allied disciplines such as anatomy, math and physics. Gloves provide comfort by preventing blister formation from propelling the wheelchair. Cargo pockets provide additional comfort and convenience for the seated posture. Short sleeves prevent getting caught in the wheels of the chair. (Figure 4)

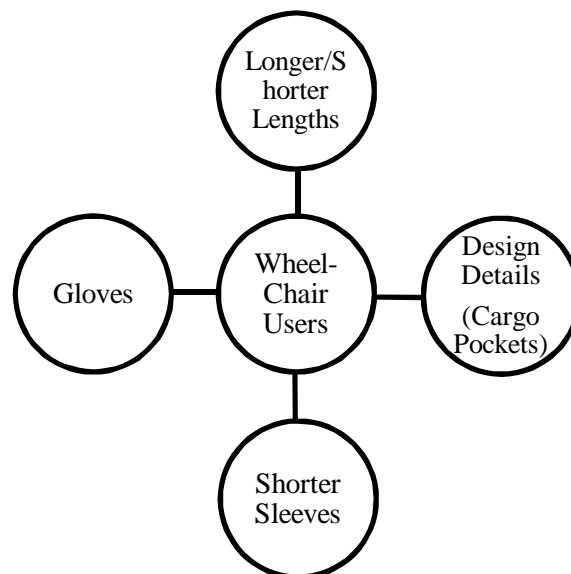


Figure 4: Creative Solutions for the Wheelchair Users

Example 5

Action Pleats for Multiple End-Uses

Action pleats are used to add movement in garments. They are an excellent addition where garment should expand while performing certain activities. Cook's gear can allow movement while lifting heavy pots and pans. Leg brace and crutch user can use action pleat in design to accommodate for leg brace and in case of crutch user for constant movement while walking (Mead, 1980). Chowdhary (2011) reported on its use by firefighters and wheelchair users too.

Firefighters' gear can use it to accommodate for excessive movement while saving people, carrying heavy hose and such other activities. Wheelchair users can have them for moving legs with ease and propelling chair without excessive pressure on the seams of the garments.

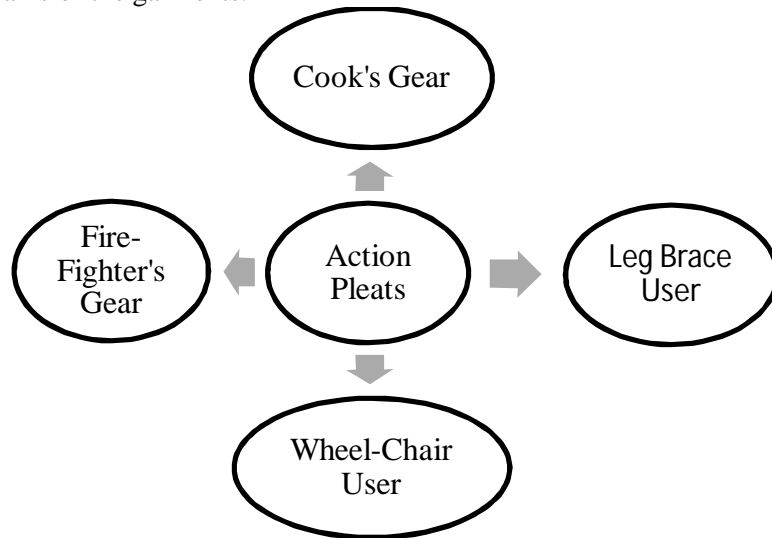


Figure 5: Cross-Application of Action Pleats

Example 6

Use of Stretch Fabrics

Stretch fabric can be used in jeans and tank tops to add comfort, and active and swim wear to incorporate flexibility. It can also be used in clothing of those individuals who have limited motion. Stretch of tubular knits is appropriate for making seamless garments and accessories. It could include wristbands, headbands, dresses, pants, shorts and other apparel. Body suits used by professional dancers and stockings by common people are also made from stretch fabrics. Stretch fabrics are good choice for compression therapy also.

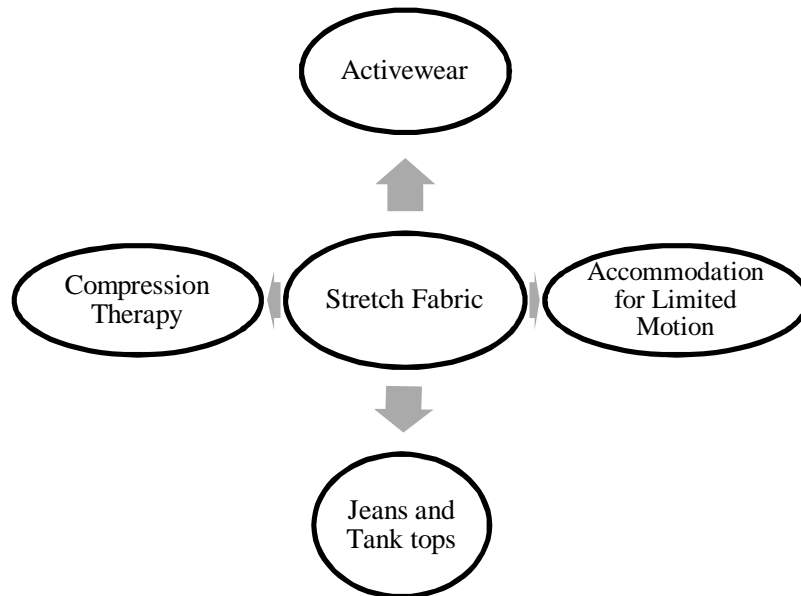


Figure 6: Multiple uses of stretch fabrics

Example 7

Anatomy and Physiology in Design

One needs to consider anatomy and physiology of human body while designing for the changing needs. There are several examples of this assertion. However, this paper only mentions four examples. Nursing mother's requirements are different from the woman who has undergone mastectomy. One needs opening to feed the baby and the other one needs a pocket in bra to hold the prosthesis. Joints need extra room for pivoting and carpal tunnel syndrome calls for compression therapy. Different needs for the seated and standing posture have already been discussed under example four. Figure seven pictorially depicts this section.

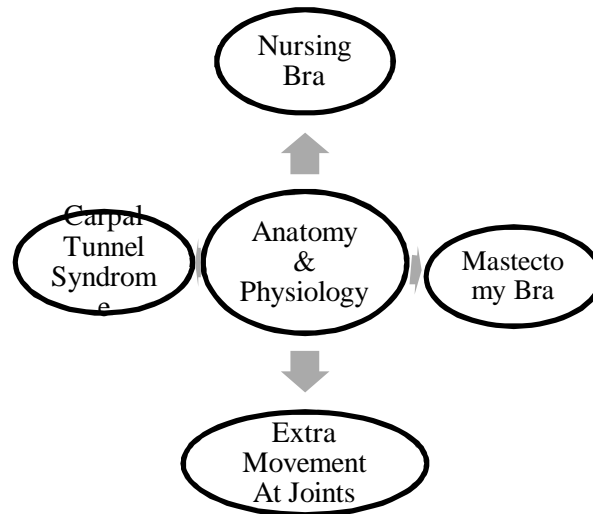


Figure 7: Multiple applications of anatomy and physiology in design

8. Cross-Application Model

Based on the previous discussion of using cross application through creative thinking and problem solving. A process-driven model is developed to explore possibilities of use existing techniques and strategies in multiple ways to synergize the effort for optimized outcome (Figure 8). The six-step process begins with problem identification and ends with applying information to the allied disciplines. The four interfacing steps of the model include exploring details, identifying related disciplines, application to problem solving and outcome.

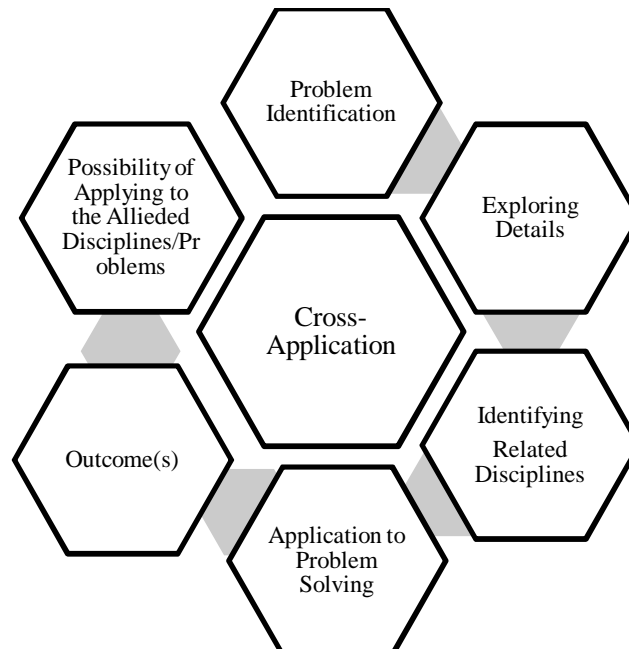


Figure 8: Cross-Application Model

Application of this model for post-mastectomy survivors will go as follows.

1. Problem identification: The problem consists of breast(s) loss, garments affected, need to use prosthesis, swelling from surgery in the arm scar formation, support to bear the weight of the prosthesis and tender tissues.
2. Exploring Details: Loss of breast calls for using prosthesis. Therefore, bra should have a pocket that could hold the prosthesis. To accommodate for the swelling in arm area compression therapy needs to be used. A tight knit sleeve could help with keeping the swelling down. Scar can be hidden with raised neckline. Wider straps should be used to hold the weight of the prosthesis that is generally more than the natural breast. Material used should be soft and flexible to prevent itching and irritation of the tender tissue. Intimate apparel, swimwear, casual wear and formal wear could be the apparel categories that would be affected the most by this procedure. It is important to know if the surgery was performed on one or both breasts because it can create balance related issues.
3. Identifying Related Disciplines: To fully understand and solve the problem, one needs to be familiar with the type of mastectomy (simple, modified, or radical) from the surgery area, anatomy and physiology to understand human body, apparel design to incorporate the needed features, and social psychology to maintain the self-esteem of the person involved.
4. Application to Problem Solving: Designers' challenge will be to retain the mainstream style and camouflage the adverse issues created from the surgery. Mainstream look can help with retaining the self-esteem of the wearer, and a tight knit sleeve can be designed to reduce the swelling with or without a gauntlet to prevent its slippage. Bra should have pocket(s) to hold the prosthesis. Straps of the bra should be wider than normal to offer firm support that can help with carrying the weight of the prosthesis/prostheses. Front opening can make fastening pain free. Back opening is hard because extensions of the arm are limited after the surgery because of the tenderness of the tissue. Bosom buddies could be used for lingerie and t-shirts to prevent the discomfort caused by the prosthesis. Swimwear can have molded cup on the side of breast loss and raised neckline to hide the scars. If support fabrics are designed to meet the special needs, casual and formal wear might not need special adjustment.
5. Outcome: A well-fitted garment and enhanced self-esteem are the outcomes.
6. Application of Information to Allied Disciplines/Problems: The concept of padding/prosthesis can be used for those individuals who have flat shoulder or hip due to scoliosis. Compression therapy is also good for those with arthritis, backaches, Carpal Tunnel Syndrome, crutches and limited motion. Well-fitted garments can result in enhanced self-esteem.

The preceding information provides several examples of the concept of cross application through creative thinking, innovation and problem solving. The concept has relevance for academe and other disciplines also. The concept of teamwork through committees from various disciplines, multidisciplinary research teams and teaching in applied fields are just few such examples. The concept of cross application suggests that certain principles and techniques can cut across disciplines. The reported work is just an exploratory step toward understanding the concept of cross application across disciplines. The process can be further understood for other disciplines, teaching pedagogy, and scholarship. The proposed model can be tested for the feasibility of its use in other disciplines.

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