

Apparel Design Students and Motivations for Creativity: An Explanatory-Sequential Study
Using Cognitive Orientation Theory

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AUTHORIZATION TO SUBMIT DISSERTATION

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Abstract

The US apparel industry is lacking in skilled workers familiar with technology, and there is a gap between what is taught in post-secondary schools and what is needed on the job. Minimal research is available to guide the apparel design educator and even less regarding apparel technologies. Apparel design students are expected to produce creative outputs during their academic careers and as apparel industry employees. Using Cognitive Orientation theory, this study determined what motivational constructs contributed most to motivations for creativity among apparel design students. Specifically, it investigates apparel design technology students' perceptions of internal and external motivations for creativity constructs, and the relationship of those constructs to creative outputs.

Using an explanatory-sequential study design, the Cognitive Orientation Questionnaire for Creativity (COQ-CR) survey was used to capture a general picture of apparel design student perceptions of motivations for creativity followed by interviews with apparel design technology students. The COQ-CR was also administered to related disciplines of interior design and costume design. A correlational explanatory design correlated apparel design technology student COQ-CR scores with final project creativity scores obtained through the Consensual Assessment Technique (CAT). Descriptive analysis of the COQ-CR was used to determine which constructs contributed most to motivations for creativity for each design discipline group. Using a constructivist paradigm, interviews were analyzed for themes which were then grouped into categories. COQ-CR and CAT scores were correlated using the Spearman Correlation Coefficient. Results indicate that apparel design students are motivated equally by internal and external factors and identified three themes and a belief construct that contributed most to COQ-CR scores. Apparel, interior,

and costume design groups scored similarly. Three relatively strong correlations and with large effect sizes were found between COQ-CR construct scores and creativity scores.

These results suggest that by leveraging innate constructs that are already part of the apparel design student motivational make-up that design project output may be more creative with less coaching from the instructor. Careful selection of project types and goals that relate to these motivational factors that are already valued by the apparel design student could support better project engagement in pursuit of a creative outcome.

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CHAPTER 1

Introduction to the Apparel Design Technology Student and Their Industry Context

Landfills are filling, consumers are wanting low-cost products, and apparel companies are looking for innovators who can solve environmental and product needs of the future while leveraging new developments in technology. With a worldwide labor force of over 3.3 billion people (FashionUnited, 2021), the textile and apparel sector is one of the top ten global employers with 430 million employees working in apparel and textile production alone (“Faces and Figures,” 2018). If one considers the entire value chain process of apparel from fiber production to fabric, from dyeing to garment assembly, and from sale to end-of-life, the apparel industry represents somewhere between 4% (Berg et al., 2020) and 6.7% of global climate impacts (Qantis, 2018). Supply chain transparency (Kent, 2020; Sodhi & Tang, 2019) is becoming the norm as consumers are demanding to know where and how their garments are made. The apparel industry is evolving rapidly as they seek processes that lower production costs while providing ethical working conditions, reduce the impact on the planet, and shorten the timeline from concept to sales floor. Companies such as Under Armour®, Nike®, Merrill® and Chico’s® are looking to technology-based tools to change how product is designed, prototyped, and produced to conserve resources (Chico’s Education Round Table, 2017; Cove, 2016; Nike Education Round Table, 2017). Even a small change in one of these processes across many companies around the globe could move one of these challenges in a positive direction. Further accelerated by the coronavirus pandemic, apparel companies are embracing technologies faster than before for product development (Barrie, 2020), fittings with clients, working with product teams, and reimagining how product is presented (Crouch, 2020; Diderich, 2021).

As technology, material, environmental, and product needs have evolved, a gap has emerged between the skills taught in universities and what is needed on the job. The MOTIF State of the Skills report for the apparel industry found that 57% of the respondents encountered challenges in filling positions due to lack of skilled applicants (Cole, 2020). The report highlighted the need for companies to motivate their employees to pursue continuous learning in areas of sustainability, strategic sourcing, and 3D technologies. Although academic settings were not explicitly mentioned in the report, it is logical to assume that if these skills are missing from current employees that these skills should be included in post-secondary education. As suggested by panel members at the Nike Education Round Table (2017), undergraduate apparel design programs need to develop motivated learners that are competent with traditional processes, fluent in current technologies, and creative in their outputs.

Apparel design students need to be motivated not only to learn new technologies and processes in preparation for employment, but also be able to demonstrate this understanding through creative design solutions. The creative output of design students is evaluated in design critiques and final collection presentations. Very little focus has been put on the underlying motivational factors that enable these innovative design results.

Background

The global economy has dramatically changed in the past 150 years as countries have shifted from a past-oriented, pre-industrial economy to an ad-hoc adaptation and experimental industrial economy and finally to the current future-focused post-industrial economy (Friedman, 2012). Design education programs centered on pre-industrial and industrial practices focusing on trade and craft are not adequately preparing students for the

new manufacturing approaches that are a result of technological advances (Friedman, 2012). The shifting landscape of emerging issues and evolving points of view in the global apparel industry and its products are a wake-up call to evolve the way apparel is designed and produced (Edelkoort, 2015). Greater emphasis is now being placed on sustainable and environmentally conscious approaches to garment production than ever before (Welters, 2015). Shorter timelines have been implemented to bring product more quickly to market using smaller work forces (Chico's Education Round Table, 2017; Cove, 2016; Nike Education Round Table, 2017) with brands such as H&M® taking product from concept to delivery in as short as three weeks (Peterson, 2017). Major evolutions in economies of the world have led to the re-examination of how design is taught as a discipline and how design students are prepared for successful employment within America and throughout the world (Faerm, 2012, 2015; Norman, 2010). This paradigm shift in the economy has opened the door for more creative approaches to new and ongoing challenges (Csikszentmihalyi, 2013, pp. 291–292). Apparel industry employers are looking for future employees who are motivated to solve problems related to sustainability and speed-to-market by leveraging new and emerging technologies (Cove, 2016; Nike Education Round Table, 2017). These changes bring about the need to prepare better innovators for the workforce who can adapt to society's changing aesthetic values, to meet the demand for fast-fashion product, and to reduce the apparel industry's impact on the planet (Cove, 2016; Nike Education Round Table, 2017; Rissanen, 2015). Students need to be motivated to learn these technologies in school and demonstrate their understanding by producing successful, creative design solutions.

Engineering and technology advancements in the apparel industry have allowed for the production of textiles and garments that can keep one cool and dry in humid climates (Jenkins, 2018), warm and dry in driving rain and frigid temperatures (Pailes-Friedman, 2016, p. 18) and, in the near-future, produce garments on demand (U.S. Patent No. 9,623,578, 2017). However, most garment development methods rely on traditional cut-and-sew (subtractive) construction leading to large amounts of waste, limited assembly processes and long lead times for new product development. Current and emerging technologies coupled with responsible, innovative designs can assist in the abatement of these issues. Additive methods like 3D printing and digital fabric printing are applying materials only to where they are needed, rather than cutting away and discarding what is not, while allowing new garment forms to emerge (Brannigan, 2015; Bumpus, 2015). Laser cutting, 3D printing, and virtual prototyping (Dyson, 2020) all reduce the development timeline thereby shortening the time from concept to finished product. New processes, such as fiber spraying and digital knitting on-demand (Kniterate, 2017), continue to emerge. Other relatively new practices, such as the incorporation of digital electronics into clothing, known as e-textiles, offers new aesthetic details that include illumination and movement (Pailes-Friedman, 2016, pp. 10-13), while also supporting functional solutions such as bio-feedback and sound “feeling” for people with hearing loss (Kettley, 2016, pp. 94–99; Marchese, 2019; Pailes-Friedman, 2016, p. 125). The fashion and apparel industry has historically relied on innovation and creativity to maintain relevance among consumers, and the evolution of the design practices and processes provide new opportunities and need for innovation and creativity. Students must not only understand apparel design technologies, but also be

motivated to use and integrate them appropriately into processes and products as they meet the product needs of manufacturers and consumers.

The Oxford English Dictionary (n.d.) defines motivation as “the (conscious or unconscious) stimulus for action towards a desired goal” or “the general desire or willingness of someone to do something.” Motivation can be an inherent tendency to explore and learn (intrinsic) or can be externally influenced by rewards or other outcomes (extrinsic) (Ryan & Deci, 2000). Researchers have recognized the intertwined role of intrinsic and extrinsic motivators in the pursuit of a creative goal (Amabile, 1996) as creative activities can be done for both self-enjoyment and as part of obtaining an extrinsic objective (Csikszentmihalyi, 1999). Motivation is a critical process that enables learning (Hidi, 2016), and, in a design context, is instrumental in the creative process and directly related to innovative outputs (Hennessey, 2003).

The determination of “what is creative” is a complex endeavor. An assessment of creativity is subjective based upon social systems, domains of knowledge, the creator and the audience viewing the creativity (Csikszentmihalyi, 1999). Standard definitions of creativity (Runco & Jaeger, 2012) incorporate both “originality” and “usefulness” (Barron, 1955; Stein, 1953), but more recent research has supported terms such as “originality”, “fit” and “appropriateness” (Kreitler, 2013, p. 35) or “novelty, utility, and surprise” (Simonton, 2012). Recognizing that creativity is tied to society and culture, Csikszentmihalyi’s (1999) systems theory-based definition of creativity situates creativity within a cultural domain that consists of symbolic rules, novelty brought into the symbolic domain, and recognition by a field of experts. At the center of cultural domain is the designer who brings his or her own

cognitive orientation to creativity. This cognitive orientation may affect motivation, creativity, and the relationship between the two (Kreitler, 2013).

Cognition is defined as “the action or faculty of knowing; knowledge, consciousness; acquaintance with a subject” (*Oxford English Dictionary*, n.d.). Cognition is shaped by culture and society, but research also shows that knowledge domain also shapes cognition (H. Kreitler & Kreitler, 1976, 1982). Knowledge domain is specialized knowledge related to a discipline (DiPietro, 2009) as opposed to general knowledge. Cognitive Orientation (CO) theory explains human action whether cognitive or otherwise as driven by motivational disposition and “a behavioral program” that describes processes that occur between input and output. (Kreitler, 2013). Formed by a cluster of four types of beliefs, motivational disposition (behavioral intent) creates meaning of the potential act for the individual. The behavioral program is made up of cognitive contents and processes which are distinct from motoric or physiological elements. Cognitive contents are “structured in sequences, schemes, strategies, or heuristics” and are made up of items of information and combinations of these items (Kreitler, 2013). Due to differences in beliefs, two individuals with different motivational dispositions for cognition may deploy cognition differently and may complete a task differently from one another (H. Kreitler & Kreitler, 1982). A better comprehension of apparel design students’ motivational factors would help educators understand how the motivational disposition of their students impacts their behavioral program and future actions. This knowledge could contribute to improved pedagogical design and instruction methods as educators train the next generation of apparel designers to be successful in the ever-evolving apparel industry.

Frameworks

A study's theoretical framework provides the theories that explain the relationships between the constructs while the conceptual framework explains why the topic of the research matters and why the approach is appropriate (Ravitch & Riggan, 2017, p. 5). This study uses Anfara and Mertz's (2015) definition of a theoretical framework that "...any empirical or quasi-empirical theory of social and/or psychological processes, at a variety of levels (e.g. grand, midrange, explanatory), that can be applied to the understanding of phenomena" (p.15). Developed using Cognitive Orientation (CO) theory (H. Kreitler & Kreitler, 1990), this study contextualized the apparel design students learning to use technologies within the environment of the global apparel industry, knowledge domain, and the design process used for creative product development.

Theoretical Framework

Cognitive Orientation (CO) theory supposes that "any act, cognitive or other, is a function of a motivational disposition and a behavioral program" (Kreitler, 2013, p. 35). Motivational disposition (behavioral intent) is formed by a cluster of beliefs about self, norms, goals and general beliefs while the behavioral program is made up of cognitive contents and processes (Kreitler, 2013). Meaning has a paramount role in CO theory and is a pattern of cognitive contents concentrated around inputs combined with the subject to form a meaning (H. Kreitler & Kreitler, 1990).

Formed in the late 60's and largely based upon observable behaviors, CO theory has evolved through the research of multiple content areas including health, medical, emotions, and psychopathologies (H. Kreitler & Kreitler, 1972, 1982, 1990). CO theory has been applied to distinct domains of content from breastfeeding (H. Kreitler & Kreitler, 1994) to

design (Kreitler & Casakin, 2012), from mathematics (Kreitler & Nussbaum, 1998) to smokers and smoking behavioral therapy (S. Kreitler, Shahar, & Kreitler, 1976) and is well validated in the literature. The accompanying CO Model, shown in Figure 1 describes the cognitive process of the behavioral program that begins with identifying input needing conscious action, making meaning (both for action and for the individual), deciding what type of action is required (viewed through a participant’s CO), choosing how to perform the action, and finally executing the output or behavior (Kreitler, 2013, p. 38).

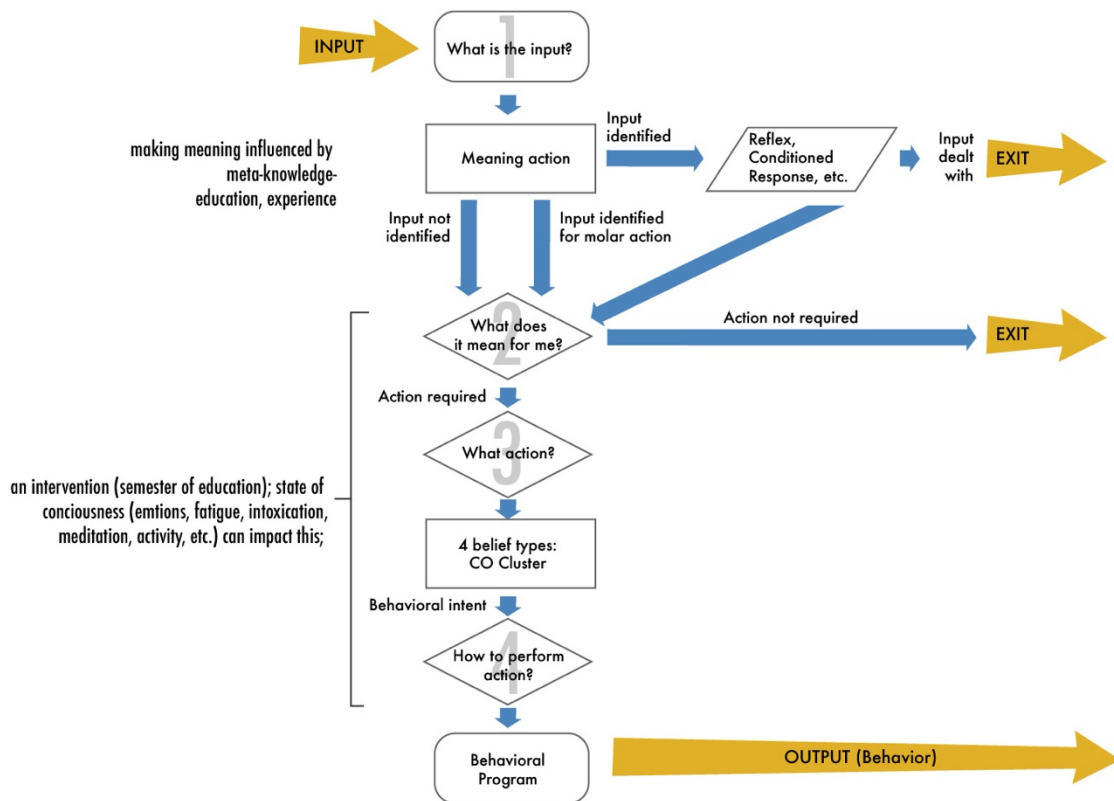


Figure 1. Cognitive Orientation Model. Adapted from “The Structure and Dynamics of Cognitive Orientation: A Motivational Approach to Cognition.” By S. Kreitler, 2013, *Cognition and Motivation: Forging an Interdisciplinary Perspective*, p.38. Copyright 2005 Cambridge University Press.

Different motivational dispositions for cognition deploy cognition differently based upon a person’s cluster of beliefs (Kreitler, 2013), indicating that individuals with different

cognitive orientations may approach and complete a task differently using different types of thinking, meaning making, and motivational dispositions. Kreitler (2013) defines types of thinking as “structurally and motivationally defined kinds of thinking that direct the activation of cognition along specific lines” (p.47). Three CO questionnaires have been developed to measure motivation perceptions for specific types of thinking: creativity (S. Kreitler & Casakin, 2009), inventiveness (Kreitler, 2009), and intuitive thinking (Kreitler & Margaliot, 2012). While a CO questionnaire can be used to predict a behavioral outcome, it can also be used as a tool to identify motivational characteristics (Casakin & Kreitler, 2010). For purposes of data collection for this study, the cognitive orientation questionnaire for creativity (COQ-CR) was used. Containing 59 Likert-type statements, the COQ-CR assesses beliefs about self, norms, goals, and general beliefs. The responses can be grouped into two factors (oneself and external world) and eleven themes. The questionnaire has been used with design students in other disciplines (Casakin & Kreitler, 2010) and is appropriate for this study as a tool to discern constructs that impact motivations for creativity. The instrument is further described in the Methods section of this report.

Conceptual Framework

The Cognitive Orientation (CO) theory and the accompanying CO model (Kreitler, 2013) and the Systems Model of Creativity (Csikszentmihalyi, 1999) are considered together providing context for the traditional design process (Aspelund, 2010, pp. 3–9) and are shown embedded within one another in Figure 2. The apparel design student is at the center using the design process to complete a project. The next layer represents their cognitive orientation which is the lens that the design student brings to a situation as a result of their beliefs about self, norms, goals and general beliefs which contribute to their

motivational disposition or behavioral intent (Kreitler, 2013). Finally, the environment is shown on the outermost layer and contains factors that impact the student. The Systems Model of Creativity situates creativity within the sociocultural context and answers the question “where does creativity take place?” (Kozbelt, Beghetto, & Runco, 2010) while emphasizing the importance of context when considering creativity (Csikszentmihalyi, 1999).

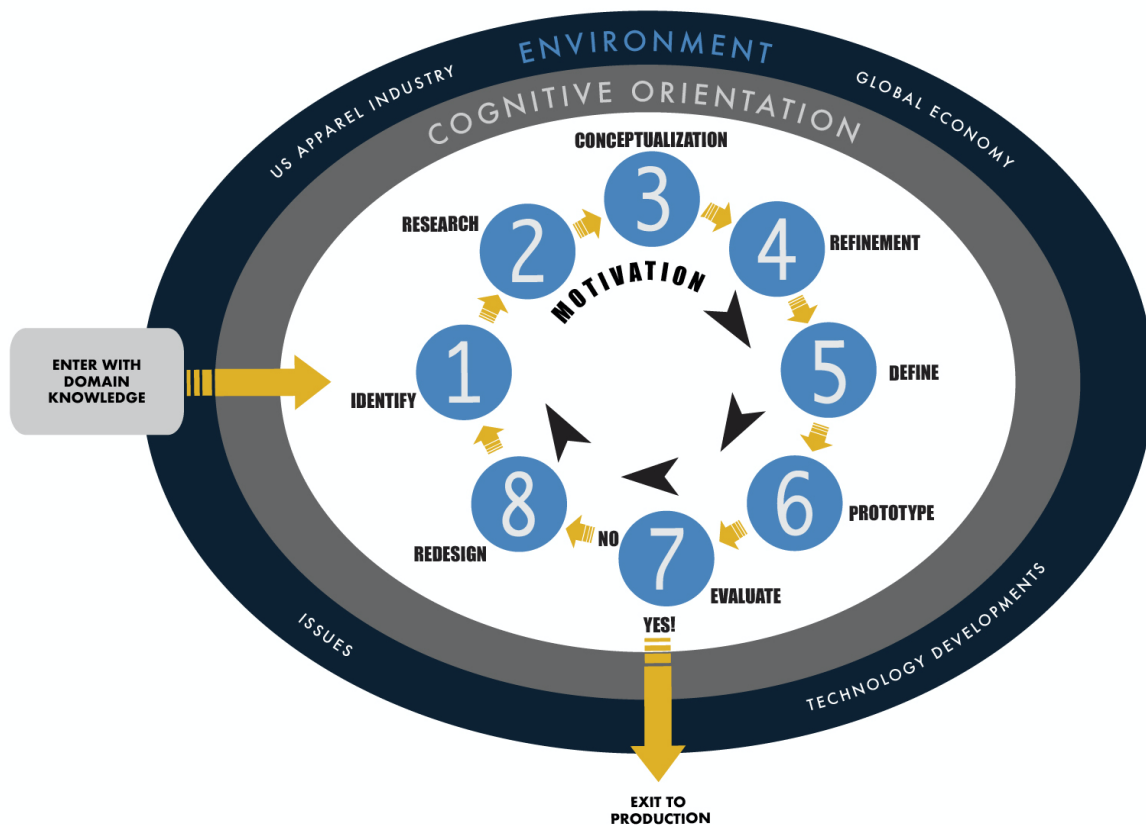


Figure 2. Conceptual Model for Study. The model situates the design process, adapted from “What is the Design Process.” By the Chicago Architecture Foundation, n.d., <https://www.discoverdesign.org/handbook>; within the cognitive orientation of the designer, placed in the environmental context adapted from “A systems perspective on creativity.” By M.Csikszentmihalyi, 1999, *Handbook of Creativity*, p. 4. Copyright 1999, Cambridge University Press.

Product designers use a design process composed of several stages to move from an idea to a physical prototype (Aspelund, 2010, pp. 3–4). A designer enters the multi-step

process bringing meta-knowledge, inspiration and motivation (Aspelund, 2010, pp. 18–20) to solve a design problem. The problem is defined, a possible solution decided upon (based upon a combination of meta-knowledge and research), active experimentation produces a result or event, that result or event is reflected upon, and then either further experimentation is required or the results are acceptable and the user exits the process ready to present their solution to the relevant stakeholders (Aspelund, 2010, pp. 2–9). Since the design process is taught in design schools and practiced in industry settings, it is appropriate to use the design process as the central component of the conceptual framework model for this study.

While the design process explains the procedure a designer typically follows, it cannot exist without the cognitive orientation of the designer informed by Cognitive Orientation (CO) theory (Kreitler, 2013) or the interaction between the designer's thoughts and the sociocultural context provided by Csikszentmihalyi's Systems Model of Creativity (1996, p.23; 1999, p. 4). The knowledge domain of the design discipline and situations occurring in the environment impact the assessments and decisions made at each stage of the process (Aspelund, 2010, pp. 40–64) including the recognition of the human end-user of the product (Friedman, 2012). For this reason, the design process is placed within the context of Cognitive Orientation and then situated within the system of the United States apparel industry and the global economy including current industry challenges of speed-to-market, sustainability and environmental requirements, and new technologies appear in Figure 2. The researcher also acknowledges that participants' prior knowledge and experience (Knowles, 1984) affects motivations for creativity. When the CO model and the Systems Model of Creativity are considered together, a more accurate overall picture of the designer working on a design-problem within their domain and socioeconomic/sociocultural context

is presented. This approach is supported by Hennessey's (2003) research as she advocated for the inclusion of environmental factors, citing their significant impact on motivation and creativity.

Problem Statement

Advances in technology have been so rapid that apparel industry companies are finding skill gaps among their employees (Cole, 2020). Apparel education programs must be proactive in incorporating current content to avoid knowledge gaps in their curriculum and to produce well-prepared job candidates. Recently, there has been an increase in interest and use of e-textiles and 3D virtual prototyping. The rapid adoption of e-textiles is due to technological advances in washability and available materials (Çelikel, 2020; Victorino, Jiang, & Menon, 2018). The creation of 3D virtual garment prototypes before the creation of a physical prototype is becoming a more common part of the product development process (Barrie, 2020) as designs can be moved from a 2D to a 3D environment quickly to assess fit and styling. The virtual prototype removes one physical prototype from the development process thereby reducing materials, labor costs, and shipping costs (time, money, carbon emissions) typically incurred. Optitex, maker of digital patternmaking and 3D garment modeling software, is asking apparel design education programs to stay current with technology both in present use and prepare for future evolution (Cove, 2016). In order to understand perceptions of 3D garment modeling technologies, researchers interviewed academics, independent professionals (freelancers), professional 3D software users, and vendors and found apparel industry professionals and vendors embraced the concept and benefits that it afforded while academic participants were concerned about time to learn the software and how the tool compared to traditional methods (Papachristou & Bilalis, 2017).

Accelerated by the COVID pandemic, the rapid adoption of technologies have allowed apparel companies to continue operating, meeting with clients, and producing products (Brown, 2020; Diderich, 2021). Some of these technological adaptations may become a permanent part of apparel company operations (REWIND, 2020). Post-secondary programs must adapt their curricula to include apparel technologies.

Purpose

The purpose of this study was to examine apparel design student perceptions of motivations for creativity within an apparel design technology context. This investigation contributes to the existing literature in design education and to the emerging area of apparel design education relative to design technologies that meet the employee knowledge needs indicated by industry stakeholders (Chico's Education Round Table, 2017; Cole, 2020; Nike Education Round Table, 2017). This is the first study to use Cognitive Orientation (CO) theory to describe motivational constructs of apparel design students and to compare and differentiate these constructs with students from related disciplines. Prior CO theory research with students has found differences in motivational constructs between architecture and engineering students (Casakin & Kreitler, 2010), and it is reasonable to predict that there are belief differences in motivations for creativity between such as apparel, interior, and costume design disciplines.

The findings from this study will contribute to a better understanding of apparel design student motivational factors, their perceptions of motivations for creativity within an apparel design technology context, and to discern a relationship between motivational factors and creative output. These results may help apparel design educators better present and teach design technologies to apparel design students. There is a clear need to start

building pedagogical knowledge in this area to proactively educate students who are ready to take on challenges, rather than reactively educate and produce underprepared future employees who may require intensive on-the-job training to close the knowledge gap. This study has established the groundwork for future larger studies that will explore motivations for creativity among apparel design students in other locations, school sizes, and with other technologies.

Research Questions

Motivation is instrumental in the creative process and is directly tied to creative and innovative outputs (Hennessey, 2003). It has also been shown to be a factor of thinking and cognition (Runco & McGarva, 2013). The overarching research question this study addressed is:

What are apparel design student perceptions of motivations for creativity within an apparel technology context and do these perceptions have an association with creative output?

Research Sub-Questions

The study's research question was conceptualized as three related sub-questions. Both quantitative and qualitative methodologies were utilized in the research design creating a scaffolded study with each sub-question evolving from and being supported by the previous sub-question and its results.

- Sub-question 1: What constructs contribute most to perceptions of motivations for creativity for apparel design students and how do these constructs differ from students in related design disciplines?

- Sub-question 2: How do apparel design students perceive external and internal motivation factors for creativity in the context of an apparel technology course?
- Sub-question 3: What is the association of motivations for creativity constructs and apparel technology project creativity scores?

To address sub-questions 1 and 2, an explanatory sequential design was used involving initial collection of quantitative data to obtain a general picture followed by the collection of qualitative data through interviews to further understand the quantitative findings (Creswell, 2012, pp. 542–543). Results collected from the COQ-CR survey created the broad understanding of apparel design student perceptions of motivations for creativity and informed the question set used during the interviews to answer sub-question 2. Interviews with a bounded case of apparel technology design students explained the quantitative results with a specific focus on external and internal motivators. Sub-question 3 used an explanatory correlational design to investigate the association between COQ-CR survey results and creativity scores among the apparel technology students. Creativity scores were collected using the Consensual Assessment Technique (CAT) which utilizes a panel of expert judges to assess project creativity (Hennessey, Amabile, & Mueller, 2011). When the findings from each of these sub-studies are considered together, a broad yet focused explanation of apparel design technology student motivation constructs are revealed including the relationship of those motivators to creativity.

Apparel education programs must remain current with industry practice and be able to adapt and expand content quickly. Based upon the adoption of apparel technologies by the apparel industry, the projected skill needs of future employees, and upon a review of the published research literature, there is a gap in the research. This problem warrants

investigation as there is minimal research to support the apparel design educator in the development of curriculum and pedagogical methods. Without an understanding of motivational factors of the apparel design learner, educators may have difficulty motivating students to learn and create innovative outputs within new topic areas such as apparel technology. Minimal research has been done exploring the apparel design student's academic experience and even less related to learning apparel design technologies. A better awareness of aspects of motivation associated with creative output in an apparel technology design context can inform curricular design, develop better integration of design technologies into existing courses/programs, and guide evaluation methods while addressing knowledge gaps outlined in apparel industry reports. The findings from this study will contribute to the emerging body of knowledge surrounding the apparel design student as a learner and to the best practices for teaching apparel design technology content in our current world.

Definitions

3D Printing-- an additive manufacturing process where computer-controlled machinery deposits material in successive layers

Apparel-- personal attire or clothing of a particular kind (Webster, n.d.)

Creativity-- originality, fit and appropriateness within the interaction of a system composed of three elements: a culture that contains symbolic rules, a person who brings novelty into the symbolic domain, and a field of experts who recognize and validate the innovation (Csikszentmihalyi, 1999)

Cognition-- the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses (Oxford Dictionary, n.d)

Cognitive Orientation-- any act, cognitive or other, is a function of a motivational disposition and a behavioral program (Kreitler, 2013)

Design Process-- a process composed of several stages to move the designer from an idea to a physical prototype (Aspelund, 2010, p. 3–4)

E-textiles-- the incorporation of digital electronics into clothing by applying, sewing, embroidering or incorporating conductive materials (Pailes-Friedman, 2016)

Fashion-- the apparel, footwear, accessories, and home fashion industries and any associated industries that contribute to the manufacture and selling of fashion products (Burns, Mullet, & Bryant, 2016, p. 2)

Generation Z-- people born after 1996 (Parker & Igielnik, 2020)

Laser Cutting-- of a beam of concentrated light that cuts by melting, burning or vaporizing materials (Baker, 2015, p. 10)

Motivation-- the desire or willingness to do something (Oxford English Dictionary, n.d)

CHAPTER 2

Literature Review

The objective of this study is to investigate and describe apparel design student perceptions of motivations for creativity and the association of these perceptions with creativity within an apparel design technology context. An overview of the apparel industry and its current and projected utilization of technology is presented to provide context for the industry that the study participants are preparing to enter. The apparel industry has transformed dramatically since the advent of design training, and post-secondary educational practices may not reflect current industry needs. A brief history of design education is presented that transitions into a review of recent literature regarding the emerging adult learner contextualized in design education. Motivation and creativity research is examined within the context of creative output rather than creative problem solving which reflects typical apparel design evaluation methods both in academia and professionally. Cognitive Orientation (CO) theory is used in this study to explain the relationship of cognitive orientation to motivation and how knowledge domain impacts motivation (Kreitler, 2013). A short history of CO theory and its use across various disciplines is presented to establish appropriateness of the theory and its survey instrument for this study. Finally, the Consensual Assessment Technique (CAT) is discussed and how its subjective method of assessing creative output was developed and why it is used.

Many of the key considerations addressed in this study are well researched, while others, such as those relating to apparel design education and specifically apparel design technology education, are emerging and have minimal resources in the research literature. A review of published apparel design education research revealed few studies on apparel

design students learning to use technologies. Of those studies, the majority focused on student skill development or teaching methods for 3D modeling and virtual fitting. No studies were identified that identified underlying motivational constructs for apparel design student learning. Cognitive Orientation theory or the Cognitive Orientation Questionnaire of Creativity did not appear to have been used in research with apparel design students. It would appear that apparel design students are an underrepresented group in the educational pedagogy literature.

This review of literature specifically reviewed the following databases: Psychology and Behavioral Sciences Collection, Academic Search Premier, ProQuest, PSYC Articles, JSTOR, and Google Scholar. Books, popular press, websites, industry reports, dissertations, and other resources were used in order to establish an understanding of existing research surrounding apparel design technologies in an educational setting and to determine future skills needed of apparel industry employees. In addition, personal correspondence with motivation researchers and apparel industry experts also occurred. Key search terms used were: motivation, creativity, motivation for creativity, apparel design education, apparel design pedagogy, and apparel design technology.

Global Apparel Industry

Apparel design students are preparing for careers in a field full of constant change and evolution. At the time of this research, environmental choices, sustainable practices, and human ethical issues are being scrutinized by consumers as they choose where to spend their dollars while innovations in technologies are changing traditional methods of practice. The shifting landscape of these emerging issues and evolving points of view in how we make and use apparel products are a wake-up call to dramatically change the way apparel is

designed, produced, and consumed (Edelkoort, 2015). These changes have been further accelerated by the COVID pandemic as companies seek innovative ways to continue business amid lockdowns and social distancing (Marr, 2021). The current state of the global apparel industry will be briefly summarized in this section to set the industry context for the reader.

Changes in Society's Values

Consumers are holding brands more accountable for sustainable and ethical practices, and supply chain transparency (Sodhi & Tang, 2019) as they are demanding to know where and how their garments are made. If one considers the entire value chain process of apparel from fiber production to fabric, from dyeing to garment assembly, and from sale to end-of-life, the apparel industry represents somewhere between 4% (Berg et al., 2020) and 6.7% of global climate impacts (Qantis, 2018). Keenly aware of greenwashing practices where companies imply that their goods are more sustainable, environmentally friendly, and ethically produced than they actually are (Lavinia, 2021), consumers are looking for verification that companies' claims are accurate. Internationally known European textile standards company, Oeko-tex provides material testing standards related to human health and the environment and provides certificates to those material manufacturers who meet or exceed their standards ("OEKO-TEX® - Tailor-Made Solutions for the Textile and Leather Industry," n.d.). Garment manufacturers using Oeko-tex approved products can add the Oeko-tex seal and standard number that they have met to their product hangtag as well as a label number that can be entered by the consumer into the Oeko-tex website to verify that the health and environmental claims are accurate. REMOkey provides manufacturers with an environmental impact reduction value based upon the percentage of

recycled material in the product and validation of recycled material claims which can be accessed by consumers through a QR-code that can be included in hangtags (Farra, 2020; “REMOkey.Com,” n.d.)

The rise of the Gen Z generation as a product consumer is impacting how companies conduct business and make products. More experience oriented than previous generations (Bhargava, Finneman, Schmidt, & Spagnuolo, 2020), members of Gen Z will represent 82 million people by 2026 and will be the largest generation in the United States (Fontelera, 2020). Gen Z is grounded in a search for truth, is ethically oriented in their worldview, and will assess a brand’s ethics, mission, and societal impacts before making purchases (Rahilly, 2020) or considering employment (Francis & Hoefel, 2018). As this generation matures, they will represent a large amount of purchasing power in the consumer market. If apparel brands want to remain successful, they must intentionally address Gen Z’s values in order to include them as part of their customer base which will be critical to financial success (Francis & Hoefel, 2018).

Product Development and Production

With greater emphasis now being placed on sustainable and environmentally conscious approaches to garment production (Welters, 2015), production methods and consumption practices of apparel and fashion products need to change or the industry faces an unsustainable future (Edelkoort, 2015). Many companies have evolved their fiber and fabric sourcing choices. US-based outdoor apparel manufacturer Patagonia re-envisioned its supply chain process and focused on finding continually recyclable fibers through a cradle-to-cradle approach (Gullingsrud & Perkins, 2015) and used fabric made from recycled soda pop bottles for their Synchronilla jackets while reducing oil consumption and toxic air

emissions (Kaiser, 2015). Cradle-to-cradle processes intertwine ecology, economy and equity as the end of one product's lifecycle becomes the beginning of another product in pursuit of infinite recyclability (Kaiser, 2015). In the case of the soda pop bottle, the bottle's lifecycle had ended once the bottle was empty of soda pop. Instead of throwing it away, it was recycled into new fiber that was spun into yarn and then knit into fabric. Nike continues to evolve cradle-to-cradle design, development and production approaches (personal correspondence from Suzan Karp, October 23, 2017), and recently outlined their approach to mitigate waste and care for the planet in their FY2020 Impact Report (Nike, 2020). The United Nations Ethical Fashion Initiative (<https://ethicalfashioninitiative.org>) recommends changing how product is sourced and produced by moving away from the current model of buying components from all over the world and shipping to the location with the cheapest labor to sourcing everything from within one community. This model reduces carbon emissions from shipping and supports small, local economies often with high levels of poverty while hitting both environmental and socially oriented metrics important to consumers (Ethical Fashion Initiative, 2016).

Fabric waste is an issue in traditional cut-and-sew processes where many layers of fabric are stacked on cutting tables, and the pattern is placed on top and cut. It is estimated that 10 to 20 percent of fabric is discarded after the cutting process (Abernathy, Dunlop, Hammond, & Weil, 1999, p. 16; Cooklin, 1997, p. 9). In response, zero-waste designers are striving to eliminate any waste from the cutting process by allowing the shape of the garment to be dictated by the most cloth-efficient cutting method which results in dramatically divergent garment shapes and materials (Rissanen, 2015).

Fast Fashion

Shorter product development timelines have been implemented to bring product more quickly to market using smaller work forces (Cove, 2016). Fast-fashion brands such as Top Shop, H&M, and Zara are offering low-cost products to their consumers more frequently than the traditional 4 or 6 product seasons a year (Hayes, 2021). Prior to the pandemic, some retailers were bringing in new product several times a month (Nguyen, 2020). with brands such as H&M taking product from concept to delivery in as short as three weeks (Peterson, 2017). Often these products are produced in factories with low labor costs and unsafe working conditions in an effort to keep the price per piece low and the production quantities high. When the Rana Plaza factory in Dhaka, Bangladesh, collapsed in 2013 killing 1132 people and injuring more than 2500 (International Labour Organization, 2017), images showed various fast fashion labels, hang tags, and sewn products mixed among the bodies and rubble. Events like Rana Plaza show the human cost of rampant consumerism in the pursuit of cheap, quick fashion.

Technological Advancements in the Apparel Industry

Creative apparel designers have 3D printed garments (Brannigan, 2015), transformed fabrics both visually and functionally with laser cutting (Baker, 2015), and allowed deaf people to feel music (CuteCircuit, n.d.). Digital technology haute couture designer, Iris van Herpen, whose 3D printed dress was selected as one of Time Magazine's 50 best inventions of 2011, was elected as a guest member to the Parisian Chambre Syndicale de la Haute Couture (Brannigan, 2015) changing the perception of high fashion. In *The State of Fashion 2020* report, both e-textiles and 3D printed textiles were addressed as areas of growth in the materials revolution of the apparel industry (Amed et al., 2019).

In an effort to reduce cost and increase speed-to-market of products, Nike is searching for employees that are problem-solvers who can use technology to meet their goals for on- and near-shoring, shortening product development timelines, and reducing or eliminating unnecessary and costly prototypes (Nike Education Round Table, 2017). On-shoring is moving or returning production to a brand's home country while near-shoring is moving production to a factory in a brand's region (Maker's Row, 2016). Nike is not alone in this shift to return production to the Americas. Brands such as Walmart, Brooks Brothers, Under Armour, and others are looking to produce in the United States again (Menon, 2020).

However, labor costs are much higher in the United States than in overseas manufacturing locations. The COVID pandemic has magnified the United States' dependence on foreign production sources as many products were missing from store shelves as a result of trade and shipping shut-downs and no domestic manufacturers available to produce the missing products (Kroupenev, 2020). In response, there has been a renewed interest in US- based manufacturing (Adams, 2020). A survey of 500 people by the Reshoring Institute (Evans & Coates, 2020) found that 70% would prefer products made in the USA and 60% would be willing to pay more for those products. A Reuters-Ipsos poll of Americans indicated that they support the idea of Made in USA product and 63% believe that U.S. agencies should buy more products in general, but when it comes to their own purchasing, 37% stated "that they would not pay a penny extra for [made in U.S.A. product]" (Aepfel & Kahn, 2021). While it appears that the majority may be willing to pay more, it would be prudent for manufacturers to control costs through efficient methods of design and development where appropriate and to avoid dramatic increases in retail price points.

Companies such as Under Armor, Merrill, Nike and Chico's are using digital patternmaking and 3D virtual fitting systems from Optitex (Cove, 2016), Gerber (King, 2017) and 3dMD (Lane, 2017) to virtually prototype garments by replacing a first prototype with a virtual one (Cove, 2016). 3D printing is used for rapid prototyping of components (Waller & Fawcett, 2014). Virtual fitting systems and 3D printing both use similar digital modelling systems with garments or objects created in a virtual environment and can be explored by rotating the object 350 degrees on three axes or in motion. These systems allow a design team to create and review prototypes very quickly as there is no physical prototype made. Physical garment prototypes require a pattern, fabric, and labor to cut and sew a garment for review consuming time and resources. Using a virtual system, a 3D designer can move from a digital pattern to a virtual prototype in a few hours or less and consume no material or labor.

Nike and Perry Ellis have recently hired 3D apparel designers (S. Michaelson, personal communication April 5, 2021), and a search for this job type on Indeed.com on April 5, 2021 revealed four apparel design job openings seeking 3D apparel modeling skills with The North Face and L.L. Bean among the companies. Suzan Karp from Nike (personal communication, April 2, 2021) indicated that technologies such as 3D simulation used for virtual prototyping or 3D printing have become so widespread that students graduating with degrees in apparel design will be expected by employers to understand aspects of 3D modeling, virtual prototyping, and virtual fitting.

Excess inventory or left-over product has been a challenge for apparel brands and retailers as the traditional purchasing model has brands and stores forecasting how much product may be sold based on previous season's sales and other market indicators. Product is

produced using these estimates, and if too much product is made or the wrong product is purchased, there is excess inventory at the end of a season that is discounted or sold to a discount retailer such as TJ Maxx or Marshalls (Lazar, 2020). Too much excess inventory leads to lower profit margins as the remaining inventory needs to be marked down to sell. A better and more sustainable approach is to manufacture only what is needed by the consumer. Some companies are exploring manufacturing on-demand and mass customization. Many apparel companies are moving closer to mass customization and exploring ways to manufacture on demand for the customer therefore reducing the production of unsold product. Mass customization is a short-cycle manufacturing approach leveraging many technologies that link the customer to the factory while allowing the customer to customize the product through fit, design or personalization (Burns et al., 2016, p. 294–297). Fit expert Patrick Gottelier (Smith & McGregor, 2017) advocates for the joining of existing 3D modeling technologies such as digital body scanning and computer-aided design to manufacture the fit that the customer wants and reduce leftover garments that are destined for landfills. Amazon's patent for On Demand Apparel Manufacturing is evidence of moving closer to mass customization and on-demand manufacturing for their web-based consumer (U.S. Patent No. 9,623,578, 2017).

When the world went into lockdown due to the coronavirus, apparel companies, who had to pause traditional operations mid-season, embraced virtual prototyping and other digital tools to continue product reviews, edits, fittings, and approvals to meet production deadlines (Barrie, 2020). Accelerated by the COVID pandemic, companies have had to embrace technologies that they may have been testing pre-pandemic and are now having to implement to continue operations (Amed et al., 2020). Couture houses, who typically stage

lavish live collection presentations, have embraced digital visual technologies for meetings and fittings with clients, working with product teams, and reimagining how product is presented (Diderich, 2021).

Future Technology

The apparel industry uses a wide range of existing computer-based technologies including digital patternmaking, laser cutting, laser burning/etching, computer-managed dyeing, and photospectrometers to improve accuracy, shorten development and production times, and create innovative designs. Capitalizing on the benefits of these technologies and the need to remain competitive, apparel manufacturers are open and willing to explore new technologies that will enhance their perceived innovation in the marketplace and make design and development of product more efficient and consume fewer resources (Chico's Education Round Table, 2017; Nike Education Round Table, 2017), but they will need employees who are either trained in some of these technologies or who are willing to learn.

Apparel companies and schools are equipping lab spaces with 3D printers, laser cutters, e-textile components, digital fabric printers, and many other technologies to explore new ways of making products and incorporating new features into existing products, and along the way discovering new apparel forms (McHale, 2017; Nike Education Round Table, 2017). Nike's Innovation Kitchen (Streiber, 2016) and Blue Ribbon Studio (Nike Education Round Table, 2017) and Under Armour's Lighthouse (Scott, 2016) are leveraging apparel technology's capabilities into cost savings while exploring new ways to manufacture. Nike's Tinker Hatfield, Vice President for Design and Special Projects, speculates that we are on the verge of developing more products that change and adapt as a result of incorporating technology (Wired Magazine, 2016). Students need to be motivated to learn about these

technologies, have access to the equipment, and be prepared to creatively implement technology-driven design solutions in their academic design projects and future careers.

Technology in Education

The brief summary of the global apparel industry presented outlines many of the challenges and opportunities faced by fashion and apparel companies. These companies will be searching for innovative employees to help them reduce environmental impacts, improve their sustainable practices, mediate human ethical issues while still meeting the demand for fashion-fast product and incorporating new technologies and practices (Cole, 2020; Cove, 2016; Nike Education Round Table, 2017; Rissanen, 2015). Educators need to develop methods to motivate students to be excited about learning beyond traditional content areas and solve these industry challenges in new ways with new tools. Three technologies have been identified for use within this study due to their prevalence in the apparel industry and potential impact on the apparel development process as well as their availability for use by study participants.

3D Printing

3D printing is an additive manufacturing process where computer controlled machinery deposits material in successive layers (Hoskins, 2014). The material is applied only where it is needed rather than cutting away and discarding what is not needed from a larger piece of material. Additive manufacturing is considered a sustainable approach to product development and production as it reduces time and waste materials.

Invented in 1981 by Hideo Kodama, 3D printing began as a model creation system that used successive layers of material which corresponded to layers in a physical reference model. Three years later, Charles Hull invented stereolithography that allowed designers to

create 3D objects from digital models which then then led to the open-source movement in 2005 that encouraged people to build their own 3D printers. By 2006, the first 3D printing machine was commercially available from Objet, now Stratasys, that could print in a range of materials allowing the same model to be created in different versions (Goldberg, 2018). Although 3D printing has been available for over 30 years, it was not widely available for use in schools and homes until MakerBot released the first commercially available 3D printer in 2009 (Campus Technology, 2015). This equipment availability allowed schools, businesses, and home enthusiasts access to what was once only a factory-grade product. There was an explosion in content creation, idea sharing and innovation such as the open source 3D printable prosthetic hand designed for children (Owen, 2019).

The creation of prototypes has been part of the design process for as long as people have been making objects. A first attempt at a product may solve some of the design problem, but not all. A second attempt improves upon the first attempt, but needs further refinement, resulting in a third prototype. This continues until a final approved prototype is created which can then be duplicated for production. Traditional model-making involved the creation of a mold costing thousands of dollars to produce a prototype. If that prototype required changes, another mold would be created, again costing thousands of dollars. By using 3D software and a 3D print system, a design concept is modeled in 3D software, reviewed and edited as many times as needed before printing therefore making the first print accurate and possibility reducing the need for multiple revisions and re-printings saving both time and money. In Waller and Fawcett's (2014) editorial for the *Journal of Business Logistics*, 3D printing was identified as a technology that has the potential to transform

supply chain design and management through new approaches to product design and greatly reduced product introduction cycles.

Apparel products incorporate many hard components such as buttons, zipper pulls, toggles, snaps and buckles. Apparel manufacturers are seeking shorter product development timelines as a way to gain an edge in the retail market by delivering new product sooner than their competitors (Cove, 2016) and being able to quickly and affordably model components will help meet this goal. In addition to printing components, designers are exploring new ways of garment creation using fully 3D printed sections (Brannigan, 2015) as well as exploring the possibility of downloading and printing clothing items at home rather than purchasing at a retail establishment (Danit Peleg, 2015). Some materials used in 3D printing can be printed directly onto fabrics to enhance the aesthetic appearance or to provide functional attributes (Wahl, 2019)

E-Textiles

At the intersection of art, design and the Science Technology Engineering and Math (STEM) disciplines are e-textiles. E-textiles are textile-based projects with integrated electronics and are a subset of smart textiles (Pailes-Friedman, 2016, p. 10). In the mid-1990s at MIT's Media Lab, Maggie Orth and Rehmi Post researched the integration of digital electronics into apparel through sewing, embroidery and other methods including conductive fibers and thermochromatic inks (Pailes-Friedman, 2016, p. 27). Leah Buechley built upon this research through MIT Media Lab's High-Low Tech group from 2009-2014 (High-Low Tech, 2017) and designed and produced the washable LilyPad Arduino e-textiles kit commercially in 2007 to support the creation of interactive garments and other textiles-based products (Peppler, 2013).

The structure, properties, and function of e-textiles are vast and range from simply conducting electricity to energy harvesting, energy storage, illumination (Pailes-Friedman, 2016, pp. 53–63), or changing the shape or form of the garment through actuators (Kettley, 2016, pp. 154–155). There are broad applications in the medical industry such as researcher Amit Gupta who is using e-textile sensors to measure galvanic skin response as part of his PhD research in knitted circuits for monitoring health signals (Kettley, 2016, p. 158). Google’s Project Jacquard seeks to weave the conductive threads directly into the fabric to support touch and gesture interactivity, and in partnership with Levi’s are testing the technology in the Commuter Jacket (Chatterjee, 2019). The new features that come with the incorporation of conductivity into a garment such as luminescence or linking the wearer to their digital lifestyle, changes what can be incorporated into clothing. With a reliable power source and washable components, the possibilities and capabilities are endless.

Laser cutting

Laser cutting has been used in industrial applications since the 1960’s (Baker, 2015, p. 7) and consists of a beam of concentrated light that cuts by melting, burning or vaporizing materials (Baker, 2015, p. 10). Computer laser cutting machines are used in garment factories where a laser beam cuts along the lines of the marker (pattern) and through all layers of fabric spread upon the cutting table (Bubonia, 2012, p. 302) . If a laser cutter is used, the pattern pieces can be placed more closely together on the marker than if the cutting is done by hand or by a reciprocating blade cutting machine, thus saving yardage, reducing waste, and saving money. Because the laser is the only thing touching the garment and there is no pressure on the fabric, lasers can be used to cut very delicate fabrics such as lightweight silks without leaving marks (Williams-Alvarez, 2014) and can cut extremely

complicated designs into the cloth. Lasers can also etch designs in a range of materials including denim and leather rather than cutting completely through the material. Koos Manufacturing, producers of AG Jeans, are using lasers to etch away indigo on denim jeans in distressed patterns (Rosalez, 2016). Laser cutting machines are now available as desktop models (Groom, 2017) and have the potential to further innovate laser cutting as more people explore laser cutting in various environments.

Apparel and Fashion Design Education

Many schools use the term fashion to describe their apparel design programs and a large part of the industry is described as the fashion industry. Burns, Mullet & Bryant (2016) define fashion as it relates to “the apparel, footwear, accessories, and home fashion industries and any associated industries that contribute to the manufacture and selling of fashion products” (p. 2). Apparel is a broader term simply defined as “personal attire or clothing of a particular kind” by Webster’s dictionary and includes items such as uniforms and protective equipment. Apparel will be used as the primary term, but when referencing publications, the term fashion may be used. For the purposes of clarity, consider the terms interchangeable.

The global economy has experienced seismic shifts in the past 150 years as countries have shifted from a past-oriented pre-industrial economy to an ad-hoc adaptation and experimental industrial economy and finally to the current future-focused post-industrial economy (Friedman, 2012). Design education programs centered on pre-industrial and industrial practices focusing on trade and craft are not adequately preparing students for the new manufacturing approaches that are a result of technological advances (Friedman, 2012). Major evolutions in economies of the world have led to the re-examination of how design as

a discipline is taught and how design students are prepared for successful employment in within America and throughout the world (Faerm, 2012, 2015; Norman, 2010). This paradigm shift has opened the door for more creative approaches to new and ongoing challenges (Csikszentmihalyi, 1996).

Apparel industry employers are looking for future employees who are motivated to solve problems related to sustainability and speed-to-market by leveraging new and emerging technologies (Cove, 2016; Nike Education Round Table, 2017). However, Alavanon and MOTIF's 2018 survey of 642 apparel industry professionals uncovered a large gap between what employees learn in school and what is needed on the job with concern that academics are not staying current with industry practice (Wang & Cole, 2018). Technical Design/Product Development, Process Management, and Production were the top three areas for training needs due to anticipated technological changes and lack of skilled domestic employees. When the survey was conducted again in 2020 with 923 participants in the midst of the pandemic lockdown, the skills gap was again mentioned between new graduates and job needs, but the top three areas were Product Development, Sustainability & Environmental Management, and Product Design & Development Software Operations as important subject areas in the coming year (Cole, 2020). Both of these reports are focused on training gaps among working apparel industry professionals, but the results indicate opportunities for academia to better prepare their students to fill these gaps who will therefore require less on-the-job training.

Apparel and fashion design educational research is lacking in peer-reviewed journal articles. Although this research is focused on apparel design, due to limited research in this area, the author is including a discussion of design education as a general discipline as the

principles and approaches of design and designers are relevant regardless of product type. Architecture and engineering have more developed educational research approaches and where appropriate will be referenced in the larger context of design education.

Design Education

The current information society and knowledge-based economy requires skills beyond the vocational and/or Bauhaus approach that is still largely in place in many design schools (Faerm, 2015). The Bauhaus design teaching approach was established by Walter Gropius in 1919 at Weimar, Germany, and advocated for a workshop setting where masters not professors taught apprentices not students (Lerner, 2005). Fusing art, design, theory, technology, and practice, the Bauhaus school dramatically changed fine art and design education by moving away from instruction that depended upon copying previous styles to exposure to methods and techniques from a range of disciplines at the beginning of the education experience and then encouraging cross-disciplinary approaches to individualized work. The school closed in 1933 and its remaining masters immigrated to America teaching in post-secondary institutions and bringing the Bauhaus approach to American design education. Although the Bauhaus pedagogy strongly encourages the blending of technology and science with art and design (Lerner, 2005), many design programs have not continually evolved their teaching methodologies to accommodate multi-disciplinary knowledge, analytical problem-solving, and technology (Faerm, 2015; Friedman, 2012; Norman, 2010). Donald Norman (2010), founder of the Design Lab at University of California- San Diego, describes designers as applied behavioral scientists who work on problems involving complex social and political issues and stresses that designer's education is lacking in understanding of human and social behavior, the behavioral sciences, technology business,

scientific method and experimental design (Friedman, 2012). Faerme (2015) speculates that resistance to or lack of change may be due in part to insufficient support of pedagogical development for design academic faculty or a misunderstanding of how academically researched pedagogy relates to the creation of designers for the knowledge-based economy.

Undergraduate apparel design education in general is deficient in pedagogical research and has a very small but growing body of research related to the teaching of apparel design technologies. Design education has a long tradition of education through demonstration and material experimentation and oftentimes practitioners of design education view themselves as artists, craftspersons, and designers rather than educators or researchers (Faerm, 2012; Lyon, 2011, pp. 66–67). This could account for the limited research on design education and in particular, apparel design education. Phillippa Lyon (2011) documented the five-year design education project Centre for Excellence in Teaching and Learning Through Design (CETLD) in England with design educators located in 74 centers with the aim of finding excellent teaching practices that would benefit students. Researchers conducting the study found that many educators were not trained in educational pedagogy and did not consider themselves researchers. However, after participating in CETLD, many educators found they benefitted from the project participation and research-based educational practices that were exposed to through the projects that they carried out. This suggests that sound design education research practices would enhance the existing methodology of demonstration and experimentation.

Design Technologies as Part of Post-Secondary Design Education

As the momentum builds to move away from the traditional apparel design methods and incorporate more research, new manufacturing approaches, and new technologies, there

is a need to develop strong pedagogical research and practices (Faerm, 2015). Xu and Flowers (2015) explored the integration of 3D printing and laser scanning technology in an advanced graphic design capstone course as the students decorated a model house as part of their final project and found the benefits to students far outweighed the challenges in integrating the technologies. Laser cutters and 3D printers allowed students to create professional-looking objects while increasing their understanding of how technology supported their subject areas (Xu & Flowers, 2015), broadening their skillsets and providing more tools to solve many environmental problems that our technology creates (Xu & Flowers, 2011). Park et. al (2011) explored 3D simulation technology in support of student's spatial visualization skills as they move from 2D flat patterns into 3D garments and found positive effects while exposing students to technologies used by industry for modeling and rapid prototyping. Hodges et al. (2020) incorporated an industry collaborator in the teaching of 2D/3D virtual prototyping software to apparel design and merchandising undergraduates as part of developing an approach to teaching virtual technologies. The researchers found that the industry collaborator helped frame the technology as a current and needed skill which motivated the students' openness to learning. The authors speculated that the openness may have influenced their perception of learning this software as being essential to their future careers.

With some technologies being radically different than content typically associated with apparel design, students may need a strong sense of motivation to learn a new technology that is dramatically different than the more familiar flat patternmaking or cut-and-sew garment construction. Digital patternmaking and virtual prototyping have a steep learning curve and require more time to develop a basic understanding and user proficiency

(Hodges et al., 2020). While there are some educators working in apparel technology and researching teaching methods, a review of the literature shows a variety of methods and evaluations. This area of apparel design education is possibly too new to have established consensus for best practices. Understanding the underlying motivational constructs of apparel design students learning design technologies for the first time may reveal more effective methods of introducing students to technologies.

Emerging Adult Learners

This study focused on motivations for creativity in emerging adults in a post-secondary educational setting. Emerging adults are approximately 18-25 years of age and although legally considered an adult, do not yet have fully developed cognitive, emotional or social functions of a mature adult (Dachner & Polin, 2016). In considering adult learning, it is helpful to have an understanding of adult education, the emerging adult learner, and emerging adult education.

When Malcolm Knowles put forth his theory of adult education known as andragogy, he wrote at length about the differences between adults and children and how the assumption of one educational framework for all was flawed (Knowles, 1978). Modern adult education theory posits these five attributes of adult learning: a) self-concept moves from a dependent position to a self-directed individual; b) growth of experience becomes a resource for learning; c) readiness to learn aligns with social roles; d) learning orientation shifts from subject orientation to problem-solving orientation; and e) learning motivation comes from within (Knowles, 1984).

The second and fifth attributes specifically relate to this study and the study participants. Knowles' second attribute of *growth of experience becomes a resource for*

learning is interpreted by this researcher as meta-knowledge and is a critical part of meaning making in the CO model as well as underpinning the knowledge the designer brings into the design process. The shift from simply learning about a subject to applying knowledge from prior experiences to solve a problem aligns with the design process (Aspelund, 2010) that is used to solve a design problem. The final attribute of *learning motivation comes from within* highlights the change in motivation from extrinsic to intrinsic sources. The focus on intrinsic motivation aligns with research at the time on motivation and creativity that thought intrinsic motivation resulted in more creative outputs. Subsequent motivation research has found a combination of intrinsic and extrinsic factors to be more typical of creatives (Csikszentmihalyi, 1999; Hidi, 2016). The second sub-question in this study specifically reviews external and internal forces that affect the apparel design student.

General adult education theory provides a road map for educating emerging adults. However, educators working with recent high school graduates need to recognize that these graduates' self-concepts are still developing and may not align directly with all adult education attributes (Dachner & Polin, 2016). In his Emerging Adulthood theory, Arnett (2000), describes the emerging adult as not yet bound by societal roles and expectations and experiencing a period of "profound change and importance" (p.1). Distinct from adolescents and young adults, the emerging adult is in a period of experimentation and exploration as they find and develop qualities to become self-sufficient. Characteristics that matter most to the emerging adult are "accepting responsibility for one's self and making independent decisions", and "becoming financially independent" (Arnett, 2000, p. 7).

Generation Z

Born after 1996, the participants in this study are part of Generation Z (Gen Z) and are quite different from previous generations (Parker & Igielnik, 2020). Relying on social media for connection to others and for information, Gen Z are digital natives who value social responsibility and prioritize diversity in all forms more than any previous generation (O'Boyle, Atack, & Monahan, 2017). They prefer to have “diverse and entrepreneurial” career opportunities with a balance of work and life and a personal career path and place great importance on a 4-year college degree (Gomez, Mawhinney, & Betts, n.d.). Research targeting the Gen Z learner is still in its early stages, but there is growing evidence that this generation is very different from previous generations and that efforts should be made to evolve pedagogy to meet Gen Z's distinct learning style (Faerm, 2020).

In a 2016 study of Gen Z college students, more than 70% “identified with characteristics of loyalty, thoughtfulness, determination, compassion, open-mindedness, and responsibility” (Seemiller & Grace, 2016). In her book, *Generation Z in the Workplace: Helping the Newest Generation in the Workforce Build Successful Working Relationships and Career Path*, Dr. Candace Steele Flippen (2017) adds “eager, hardworking, creative, and motivated” as additional characteristics. Motivated by their passions and advocacy for others, Gen Z endeavors to make a positive impact on others' lives and to take responsibility to complete commitments (Seemiller & Grace, 2016). Preferring to connect their learning to real-world issues, Gen Z's learning modalities gravitate toward intrapersonal approaches using video-based and demonstrative learning where they can see the task that they are about to undertake (Seemiller & Grace, 2019). Seemiller and Clayton (2019) recommend modifying pedagogy to include intrapersonal reflection, video-based learning, and

scaffolded learning experiences that allow students to see their progression. This generation may have lower self- and social confidence and activities that build these attributes are vital for their self-development (Seemiller & Clayton, 2019). Social impact is a big motivator for Gen Z and tying their learning to real-life or applied scenarios presents an opportunity for the Gen Z student to leverage their innate passions in these areas (Seemiller & Clayton, 2019).

Opportunity

With a deficiency in the literature of apparel design pedagogy and a gap between academic-learned skills and professional skills need on the job, some have argued that there is a clear need for research that supports apparel design educators as they better prepare apparel design students for careers in the apparel industry. In Steven Faerme's 2012 article, he criticizes academic institutions for poor preparation of fashion design students for professional work and suggests a renewed focus should be on better professional preparation, mentoring, exposure to problem-based learning, research approaches, and social science. With the dramatic evolution of design technologies used for designing, developing and making apparel, pedagogical practices need to evolve and apparel design students need to be receptive to learning new skills. A logical starting point is a developing a deeper understanding of student perceptions of motivation constructs for creativity in the apparel design technology education context.

A Brief History of Motivation Research

The Oxford English Dictionary defines motivation as “the general desire or willingness of someone to do something” with drive and enthusiasm listed as other words for motivation (*Oxford English Dictionary*, n.d.). Motivation studies are context or domain

specific such as student motivation (Williams-Pierce, 2011) or even more specific-- student motivation in the apparel classroom (Barner, 2019). In an educational context, *motivation is a critical process that enables learning* (Hidi, 2016). In the context of design, motivation is instrumental in the creative process and is directly related to innovative outputs (Hennessey, 2003). Motivation researcher Kou Murayama (2018) describes motivations' critical role in his statement, "Motivation is important in almost every aspect of human behavior." This desire or willingness to take action has been studied across a vast range of disciplines, has generated a great number of theories and even been treated as a nuisance to be controlled (Simon, 1994). Shulamith Kreitler (2013) summarized the four major questions that motivational psychology researchers seek to answer:

1. Why does the organism move/behave at all?
2. Given that it moves/behaves, why does it move in a specific direction or to a specific goal?
3. Given that it moves in a specific direction/toward a specific goal, why does it move in a specific manner or way?
4. Given that it moves in a specific manner/why, why does it stop the movement/behavior? (p.34)

The first two questions presented are associated with drive theories with the second question specifically focuses on incentive and goal theories. The third question addresses instinct and habit theories and the final question deals with feedback theories.

Seminal psychological researchers Freud and Rogers each put forth different human behavior theories that intertwined motivation with almost opposing theories of self-concepts. Freud believed that human function was grounded in instinct and driven by natural and

biological forces (Freud, 1929) while Rogers proposed humans as being free-willed and making decisions based upon their individual subjective perceptions of the world (Rogers, 1989). Research attempting to validate these seminal positions has exposed some problematic elements with Freud and Roger's explanations. The two most challenging aspects are that both men drew their conclusions from patients receiving psychological therapy, and the lack of empirical evidence supporting each theory as described (Willmott, Ryan, Sherretts, Woodfield, & McDermott, 2018). What Freud and Rogers' theories lacked in non-biased research and empirical testing has been addressed in more recent theories such as self-determination theory (SDT) and Cognitive Orientation (CO) theory. Both theories are well researched and are grounded in empirical methods and demonstrate the evolution of motivational studies from Freud's humans who were subject to instinctive forces, to Roger's free-willed thinkers, and finally, to a more complex view of human motivation for behaviors. While SDT researchers investigate a human's "growth tendencies and innate psychological needs" viewed as foundational for self-motivation and personality (Ryan & Deci, 2000), CO theorists focus on acts that result from motivational dispositions and behavioral programs (Kreitler, 2013). Both theories recognize the importance of social and contextual variables and their effects on self-motivation and acknowledges the role of domain when considering an individual's self-motivation (Kreitler, 2013; Ryan & Deci, 2000). SDT is a broad theory that can applied to many settings but does not necessarily focus on creative student learning or output. Cognitive Orientation theory was selected as the theory that most closely aligned with the research goals as it readily considers the domain (cognitive orientation) of the participant and motivation within a creativity context.

Cognitive Orientation Theory

H. Kreitler and Kreitler (1969) developed CO theory in the late sixties that united findings from other theories of the time into a single cognitive model of human behavior. They presented a model for analyzing and predicting behavior with three assumptions: (a) humans have tendencies to establish cognitive orientations; (b) human behavior is not reflexive but is “directed by cognitive orientation”; and (c) knowledge of the cognitive orientation allows prediction of behavior. The researchers defined cognitive as “all the processes by which the sensory input is transferred, reduced, elaborated, stored, recovered and used” (H. Kreitler & Kreitler, 1972). The theory heavily emphasizes meaning making by the participant, and how a participant’s beliefs influences meaning making which then effects the behavioral action. CO theory has evolved through the research of multiple content areas including health and medical topics, emotions and psychopathologies (H. Kreitler & Kreitler, 1972, 1982, 1990). It has been applied to distinct domains of content from breastfeeding (H. Kreitler & Kreitler, 1994) to design (Kreitler & Casakin, 2012), and from mathematics (Kreitler & Nussbaum, 1998) to smokers and smoking behavioral therapy (S. Kreitler, Shahr, & Kreitler, 1976).

Four decades of research have refined the logic model used in CO theory into a streamlined course of action addressing meaning making, reflexive (conditioned) responses, and beliefs that contribute to behavioral intent while addressing participant abandonment of the process at multiple stages. In her 2013 book, *Cognition and Motivation*, Dr. Shulamith Kreitler outlines the formation of a motivational disposition a person experiences when approaching a task. When presented with an input, the human must first identify the input, decide what the input means to him/her, determine a course of action, and then decide how

to perform that action (Kreitler, 2013). In between determining the course of action and performance of the action, are the four types of beliefs “that represent deep underlying meanings” of self, norms, goals, and general beliefs that inform the action. A CO cluster of beliefs are formed that orient the person to perform that action while “the kind of thinking that may be applied (i.e., creative, intuitive, logical)” and the domain further drive the cognitive act (Kreitler, 2013). It is the formation of a CO cluster that allows the researcher to predict behavior given a participant’s domain. The Cognitive Orientation Questionnaire (COQ) collects participant responses that are grouped into belief types. Behavioral outcomes can be predicted by responses on the COQ if the participant scores highly in the three belief clusters that support the action. COQ’s can also be used to uncover motivational constructs of groups (Casakin & Kreitler, 2010).

Cognitive Orientation of Design

Design itself is not a pure discipline, but rather a multi-disciplinary approach using engineering, art, inquiry, and innovation to produce a product (Lyon, 2011; Sassoon, 2008; Friedman, 2012). Even though a successful designer may be versatile in multi-disciplinary skills, there is evidence that knowledge domain provides a lens with which the designer filters and processes design tasks (Kreitler, 2013). Creativity is generally regarded as an attribute of a successful designer, and a deeper understanding of motivations for creativity within a design context would reveal specific beliefs that are important to designers. CO theory attempts to place motivations for creativity within a discipline specific cognitive orientation to show how beliefs about self, norms, goals and general beliefs impact a person’s approach motivations for creativity (Kreitler, 2013). Research using CO theory has found differences in mathematic students (Kreitler & Nussbaum, 1998) and between

architecture and engineering students (Casakin & Kreitler, 2010). Based upon prior CO theory findings, it is reasonable to predict that there are belief differences within the larger domain of creativity and more specifically between related design disciplines such as apparel design (AD), interior design (ID), and costume design (CD).

Cognitive Orientation of Creativity Questionnaire

The Cognitive Orientation Questionnaire uses Likert-type statements to assess four belief types across many behaviors with each behavior using a distinct questionnaire. Questionnaires have been developed for cognition, curiosity, mathematics, chess playing, planning and other domains. Three questionnaires have been developed for specific types of thinking: creativity (Casakin & Kreitler, 2011), inventiveness (Kreitler, 2009), and intuitive thinking (Kreitler & Margaliot, 2012). The Cognitive Orientation Questionnaire for Creativity (COQ-CR) will be used as part of this study to discover motivations for creativity constructs for AD students and to compare and contrast these constructs with ID and CD students. Although CO theory and the CO questionnaires can be used to predict cognitive behaviors, the results from the questionnaire can also be used to describe beliefs in a group or to differentiate between groups (Casakin & Kreitler, 2010, 2011).

The Cognitive Orientation of Creativity Questionnaire (COQ-CR) (Appendix A) contains 59 statements intended to assess and motivation factors (2), themes (11), and belief types (4). Fourteen questions measure Self Beliefs, fifteen questions measure Norm Beliefs, thirteen questions measure Goal Beliefs, and seventeen questions measure General Beliefs. The questions are regrouped to measure eleven different themes that intersect with the four belief constructs. The themes are then grouped into two motivation factors: Focus on Oneself (internal) and Focus on the External World (external). The two motivation factors

considered in the COQ-CR are of particular interest to this research. There is a large body of research that explores intrinsic and extrinsic motivational factors across a range of domains and in particular their impacts on student learning and creativity.

Intrinsic vs. Extrinsic Motivational Factors. Intrinsic motivation is defined as “the inherent tendency to seek out novelty and challenges, to extend and exercise one’s capacities, to explore, and to learn” (Ryan & Deci, 2000, p. 70). In contrast, extrinsic motivation is “the performance of an activity in order to attain some separable outcome” (Ryan & Deci, 2000, p. 71). Many studies support the central role of intrinsic motivation in creativity (Auger & Woodman, 2016; Eisenberger & Shanock, 2003) while others provide evidence of the detrimental impact of extrinsic motivators on creative outputs (Yoon, Sung, Choi, Lee, & Kim, 2015). Social psychology research has found that rewards can undermine intrinsic motivation already present in participants who were voluntarily (intrinsically) engaged in a task (Murayama, 2018). However, due to many underlying factors, the relationship between intrinsic and extrinsic motivation and their individual impacts on creativity is complex (McGraw, 2015) and is not one of good versus bad (Runco & McGarva, 2013). Both Amabile (1996) and Csikszentmihalyi (1999) recognized the role of intrinsic and extrinsic motivators together in the pursuit of a creative goal. Creative activities are done both for self-enjoyment (intrinsic) and to reach a later goal (extrinsic) (Csikszentmihalyi, 1999). Hidi (2016) further explored the entangled relationship of extrinsic rewards and intrinsic motivators in her comparative review of existing neuroscience and psychological research articles and found that the combination of intrinsic task value and extrinsic rewards provided the most motivation for behavioral outcomes.

Creativity

While the empirical study of creativity began as early as 1870, active interest in research did not begin in earnest until around 1950 with one group focusing on creative persons and another on creative processes (Hennessey, 2003). The field of creativity as scientific research is relatively new compared to other social science subjects. As the founder of the Creativity Research Journal, Dr. Mark Runco has been studying creativity for more than thirty years and believes that creativity is the force that moves the economy and advancement forward and takes many forms across many disciplines (Richardson, Mishra, & The Deep-Play Research Group, 2016).

The determination of “what is creative” is complex as an assessment of creativity is subjective based upon social systems, domains of knowledge, the creator and the audience viewing the creativity (Csikszentmihalyi, 1999). Runco and Jaeger (2012) recommend citing the standard definitions of creativity incorporating both originality and usefulness that Barron (1955) and Stein (1953) set forth, but acknowledge that additional work is needed to refine the definition. Subsequent research to define creativity has supported the two or more criteria approach using terms as “originality”, “fit” and “appropriateness” (Runco, 1988, p. 4) or “novelty, utility, and surprise” (Simonton, 2012). However, these definitions lack the cultural context component where the item or process would be conceived, created, and evaluated for originality, usefulness/utility, and surprise. Csikszentmihalyi (1999, 2013) reframed the question of “what is creativity?” to “where is creativity?” and developed the Systems Model of Creativity that captures the central ideas of previous creativity definitions while seating his definition within a cultural domain:

Creativity results from the interaction of a system composed of three elements: a culture that contains symbolic rules, a person who brings novelty into the symbolic domain, and a field of experts who recognize and validate the innovation. (p. 6)

Creativity and creative processes exist across many settings from scientific to art, from professional to amateur. Simonton (2009) asked if a “one-size-fits-all” (p.441) approach was possible for creativity and further speculated that creativity might be domain specific.

Researcher John Baer (Baer, 2015) supports the concept of domain-specific creativity and argues that one is not creative across all disciplines just as one is not an expert across all subject matters. Therefore, it is critical to consider the context of where creativity happens when assessing motivations for creativity. This study uses Runco’s (1988) creativity definition of *originality, fit and appropriateness* in describing creative output and will use the Systems Model of Creativity (Csikszentmihalyi, 1999) to situate the creativity within a cultural system.

Motivation to Be Creative

In the context of design, motivation is instrumental in the creative process and is directly related to innovative outputs (Hennessey, 2003). Much of the motivation for creativity literature treats creative thinking, creative processes, and creative outputs as one idea that is sometimes called creative behavior (Hennessey, 2010). One can be motivated to complete something such as a process or an assignment (Oxford Dictionary, n.d.), but it is the creative quality of the output whether it is a visual board depicting the design direction or the garment design itself that is assessed in an apparel design context rather than the creative process alone (Hopkins, 2012). In a professional setting, the creative output must meet the creative direction of the company and is typically assessed by a product design

team, senior designers, or buyers representing clients (Hopkins, 2012). It is logical to assume that these same criteria would be used to evaluate the work of a new designer that a company might wish to hire. If students wish to be considered for design positions, they should be motivated to produce acceptable creative outputs and the educators that are training them must know how to encourage motivation for creativity. In 2010 researcher Amaresh Chakrabarti stressed the need for design creativity research that identified “motivational factors, their relationships, and how they affect design creativity” with the intent of applying this knowledge in design education. Minimal research was found correlating motivational factors with creative design output in a design education setting.

Assessing Creative Output: Consensual Assessment Technique

The Systems Model of Creativity (Csikszentmihalyi, 1999) supports the choice of an expert panel selected from the knowledge domain and the culture to assess the creativity of participant output. While expert panels are often used to evaluate competitions such as the Nobel Prize or determining if an article is fit for publication, it wasn't until 1982 that Theresa Amabile developed and formalized the Consensual Assessment Technique that is used to assess creativity. The Consensual Assessment Technique (CAT) is an evaluation technique used for assessing products' creativity by using independent, subjective judgements of experts from the products' domain (Hennessey, Amabile, & Mueller, 2011). It has been used across a range of disciplines and is well validated in the literature (Baer, 2015). Creativity assessments made using CAT more closely mirror real-world assessments as the judges must have experience with the domain being judged (Amabile, 1982).

Summary

This review of the literature has described the current climate of the apparel industry and its focus on sustainable and responsible practices in response to consumer demands. Current and emerging apparel technologies were discussed and how technology is used both as tool for innovation and as a method of addressing some of the industry's most pressing challenges. Many design technologies have been in use in the apparel industry pushing the envelope of both product design and methods of product development. Over time these technologies have become more widely accepted both aesthetically and functionally. The COVID-pandemic has accelerated adoption of technologies by many apparel companies. However, apparel design students are not receiving adequate training in their post-secondary education.

There is a gap between what skills are needed in the industry and what skills students are learning in school. To educate our Gen Z students and to close this gap, apparel design programs may need to change from their traditional teaching methods and embrace new content delivery approaches to teach students relevant skills that are needed now. Design technology skills are needed professionally but are not being taught consistently across AD programs as skills related to technologies were largely listed as missing on skills assessment surveys completed by working professionals. There is very limited apparel design education research and even less as the content focuses on design technologies. Many articles have been presented indicating a need to grow research in this area. To begin to develop best practices in teaching technologies, an understanding of motivational factors among AD students who are learning to use design technologies could help inform curricular design and project scope. The literature review presented a brief history of motivation and creativity

research and then brought the two topics together by specifically looking at motivations for creativity through the lens of Cognitive Orientation theory.

CHAPTER 3

Methods

This study explored the under-researched topic of apparel design students' motivations for creativity. Within this area, of particular interest were the experiences of apparel design students learning to use apparel design technologies. The overarching research question guiding the study was:

What are apparel design students' perceptions of motivations for creativity within an apparel technology context and do these perceptions have an association with creative output?

To best answer this question, three sub-questions were developed:

- Sub-question 1: What constructs contribute most to perceptions of motivations for creativity for apparel design students and how do these constructs differ from students in related design disciplines?
- Sub-question 2: How do apparel design students perceive external and internal motivation factors for creativity in the context of an apparel technology course?
- Sub-question 3: What is the association of motivations for creativity constructs and apparel technology project creativity scores?

A mixed-methods approach was selected to address the overarching research question. This approach involved distinct aspects of quantitative methods and qualitative methods used as appropriate to guide the inquiry into each of research sub-questions. Through this process, both quantitative and qualitative data were collected and analyzed.

Research Design

The first and second sub-questions of this study required the use of an explanatory sequential study design (Creswell, 2012) that used mixed methods techniques to collect data in two sequential phases. A correlational explanatory design (Creswell, 2012) was used to address the third sub-question. The correlational explanatory design used quantitative data collected during the explanatory sequential part of the study and creativity scores provided by expert evaluators.

Explanatory Sequential Design

Explanatory sequential design involves two phases of data collection: (a) the initial collection of quantitative data to obtain a general picture of the phenomenon under investigation, followed by (b) the collection of qualitative data through interviews to further understand the quantitative findings (Creswell, 2012, pp. 542–543). The quantitative data collected in Phase I was used to inform the qualitative interview protocol developed for use in Phase II.

A cross-sectional survey design using the Cognitive Orientation of Questionnaire of Creativity (COQ-CR) was implemented for Phase I of the explanatory sequential design. A cross sectional survey is used to collect data from one point in time to measure current attitudes or practices of a specific group (Creswell, 2012, pp. 377–378). The survey data captured general perceptions of apparel design (AD), interior design (ID), and costume design (CD) students' motivations for creativity. The construct scores were used to describe motivations for creativity among AD students and were also compared across the three discipline groups in search of similarities and differences.

After completing Phase I of the explanatory sequential design, the results from the AD Group were used to inform the development of the interview protocol for Phase II.

Phase II utilized explanatory case study interviews with apparel design technology students to develop a deeper understanding of the AD Group results from the COQ-CR. AD group COQ-CR scores on factors were only .05 apart indicating that both the Focus on External World factor and the Focus on Oneself factor were almost of equal importance to AD group members. Interview questions were developed to explore why and how AD students, and in particular apparel design technology students, perceived that both of these factors informed their motivations for creativity.

A case study is defined as an in-depth exploration of a bounded case distinguished by time, place, or physical boundaries (Creswell, 2012, p. 465). Explanatory case studies are used when researchers want to explain phenomena (Savin-Baden & Howell Major, 2013, pp. 151–157) while keeping the quantitative and qualitative data distinct and separate (Creswell, 2012, p. 543) or when neither quantitative nor qualitative data alone is sufficient to explain the phenomenon (Ivankova, Creswell, & Stick, 2006).

While quantitative research is concerned with general responses from participants and the variance among these responses (Creswell, 2012, p. 13), qualitative research is appropriate for research where variables are not known, the literature has little information about the phenomenon (Creswell, 2012, p. 16), or descriptions of participant behavior or beliefs is sought (Savin-Baden & Howell Major, 2013, p. 12). The qualitative interviews in Phase II of the explanatory sequential design were conducted using a constructivist paradigm that assumes knowledge is constructed by individuals based upon their own experiences (Savin-Baden & Howell Major, 2013, p. 29). Researchers who use the constructivist paradigm do not seek one truth or one experience, but rather different points of view to explain reality. Using a constructivist lens, the researcher sought to make sense of

individual student learning experiences during an apparel technology design course and how these perspectives support or oppose data collected in Phase I of the explanatory research design.

Explanatory Correlational Design

Because sub-question three addressed a relationship between the motivation factors and project creativity scores, an explanatory correlational design was selected. An explanatory correlational design attempts to explain the association between two or more variables with and all participants are treated as one group (Creswell, 2012, p. 340). This research design was employed to explore the association of COQ-CR constructs to creativity scores provided by judges who were considered experts in domain knowledge. The creativity scores were collected using the Consensual Assessment Technique (CAT). As discussed in Chapter 2, the Consensual Assessment Technique (CAT) is an evaluation technique used for assessing products' creativity by using independent, subjective judgements of experts (Hennessey et al., 2011).

Participant Selection

Multiple groups were used in this study. Three groups completed the COQ-CR survey: apparel design (*AD*) *Group*, interior design (*ID*) *Group*, and costume design (*CD*) *Group*. Each group is composed of undergraduate students enrolled in a 4-year apparel design, interior design, or costume design degree program at a public, land-grant university in the United States. These groups were used to answer sub-question one. The *Interviewee Group* used to answer sub-question two is composed of members of the AD Group who had completed the COQ-CR and were apparel design technology students. The *Correlation Group* is the final group and is composed of participants who were members of the AD

Group, had completed the COQ-CR and submitted an apparel technology design final project for external review by the judges.

A purposive sampling method was used to solicit participation in the study by - students enrolled in AD, ID or CD programs at public, land grant universities within the United States. A cross-sectional survey design was implemented that resulted in a dataset of responses from participants who were “willing and available” for the study, or, a sample of convenience (Creswell, 2012, pp. 144–145). Since the United States is large and may have regional differences, the country was divided into six-regions (Northwest, Southwest, North-midwest, South-midwest, Northeast, and Southeast) and a land grant university with an AD, ID, and/or CD program was selected from each region if available. The researcher sought equal representation from universities located in large cities and universities located in small cities as the learning experience might differ based upon resources found in varying sizes of cities. Only public, land-grant universities were selected in order to control for the academic environment. Not all programs were represented in each region. The North-midwest did not have a public, land-grant apparel design program and the Southwest did not have a public land-grant interior design program.

Eighteen schools were contacted to participate in the cross-sectional survey: six schools for apparel programs, six schools for interior design, and eight schools for costume design. One school in the northwest was used for all three programs. The Southeast land-grant university apparel design program declined to participate and was not replaced by another public institution in a neighboring state. Costume design programs typically have small enrollments so two schools were used in the North Midwest sector to increase the

sample size. Eight schools agreed to participate. Table 1 shows the initial response rates by school.

Table 1

Initial Response Rates of COQ-CR Survey Participants

Region		Apparel Design	Interior Design	Costume Design	Other
Northwest	School 1	18	6	3	2
	School 2	13			1
Southwest	School 3	17			
North Midwest	School 4		5		
South Midwest	School 5		13		
South Midwest	School 6	5			1
Northeast	School 7			7	
	School 8		29		
Totals		53	53	10	4

Final group numbers for the survey groups based upon complete records were:

- Apparel Design (AD; $n = 41$)
- Interior Design (ID; $n = 35$)
- Costume Design (CD; $n = 6$)

The Interviewee Group ($n = 9$) was a purposeful homogeneous sample and treated as a bounded case. Purposeful samples are used in qualitative research when a researcher seeks to understand a phenomenon and requires participants and sites that are “information rich” (Creswell, 2012, pp. 206–207). For this study, homogenous purposeful sampling was used as the experiences of a specific group (Creswell, 2012, p. 208) with “similar or defining characteristics” (Savin-Baden & Howell Major, 2013, p. 315) was sought. A bounded case is defined by features or behaviors that make case membership recognizable (Savin-Baden & Howell Major, 2013, p. 165). Case membership for this group was dependent upon matriculation as an apparel, textiles and design student at a small, northwestern, land-grant

university, enrollment in a 3-credit apparel technology course in either 2017 or 2018, completion of the COQ-CR, and availability and willingness to be interviewed. The Interviewee Group was used to answer sub-question 2 and in particular to understand the role of external and internal motivation factors as perceived by apparel design technology students.

The Correlation Group ($n = 10$) was a purposeful homogenous sample. Membership for this group was dependent upon matriculation as an apparel, textiles and design student at a small, northwestern, land-grant university, enrollment in a 3-credit apparel technology course in either 2017 or 2018, completion of the COQ-CR, completion of an apparel technology design final project, and the submission of final project materials for external review.

Sampling

The review of literature has shown that this research is the first of its kind. Because of the exploratory nature of this study, the participants are drawn from a purposeful sample of convenience to ensure representation of disciplines and availability and willingness of individuals to participate in the survey alone or in both the survey and interview (Palinkas et al., 2015). The case study design used in this research implies that the data collected and analyzed represents the perspectives of these participants at a given point in time. Although this study uses an explanatory sequential design, the small sample size is limiting and does not represent a significant percentage of the total population of apparel design students. In 2017, there were 1286 fashion and apparel design degrees awarded from public, 4-year institutions (Hidalgo, Deloitte, & Datawheel, n.d.). Small sample research has been challenging in terms of generalizability to the population but still has value in determining

factors that may be unique to an under-represented population (Etz & Arroyo, 2015). With limited research available on apparel design students, it is appropriate to consider this group of students as underrepresented in the design education literature.

Data Collection

Using three processes, data was collected through a survey, interviews, and expert evaluation scores. The cross-sectional survey was administered first, followed by interviews which took place over two years, and finally the collection of creativity scores provided by subject matter experts.

Sub-question 1

As Phase 1 of the explanatory sequential design, the Cognitive Orientation of Creativity Questionnaire (COQ-CR) was administered to the selected programs during the first three weeks of the Fall 2018 semester via the Qualtrics online survey website. The survey was available 24 hours a day until the close of the three-week availability window. Dillman, Smyth, and Christian's (2014) suggestions for survey administration were used as closely as possible by following an implementation timeline, including an explanation of how the results will be useful in emails to potential respondents, highlighting how the participant's advice is valuable, showing clear sponsorship by a legitimate organization, and offering mobile and web-based options to respond. The survey was developed using visual design principles such as clear headings and instructions and a reasonable amount of data on each screen to make the survey easy to understand and complete (Dillman et al., 2014).

An initial three-week survey window was opened at the beginning of the Fall 2018 semester. During the first week, each program contact was sent an email with information explaining the study and a request for their participation. A link to the COQ-CR survey was

be included in the email. Dillman et al. (2014) suggested that follow-up prompts to complete the survey may be more effective if they included additional information about the study. Therefore, three days after the initial sending of the invitation to complete the survey (i.e., Day 4), a second request was sent via email that included additional information about the study, as well as again providing the link to the survey. On Day 10, a third email was sent highlighting the option to respond via mobile or computer. The final e-mail follow-up was sent on Day 20 and included estimated response rates from each discipline and encouraged disciplines to not be “left behind” or “left out,” leveraging gamification strategies as proposed by Dillman et al. (2014). Due to low response rates, the survey window was extended by three weeks, and two additional universities were contacted using the same techniques in an attempt to increase responses for the CD group.

Survey response rates were much higher earlier in the semester. Even though the survey window was extended an additional three weeks, few additional surveys were collected during the extended time frame. The researcher speculates that as projects that are typically associated with design disciplines begin to expand, available time to complete surveys diminishes. For future studies with design students, it is suggested to conduct surveys early in a semester of study.

Instrument. The Cognitive Orientation of Creativity Questionnaire (COQ-CR) assesses constructs related to motivation for creativity and can be used to predict a broad range of relevant behaviors (Kreitler, 2013). Containing 59 item statements, the COQ-CR assesses beliefs about self, norms, goals and general beliefs using Likert scale responses and asks participants to indicate whether they strongly agree, agree, disagree or strongly disagree with each statement (see Fig. 3 and Appendix A). The four types of beliefs are: 1) Self

Beliefs that includes “habits, routines, actions and feelings”; 2) Norm Beliefs about rules and standards (or norms) which includes social and ethical rules and standards ; 3) Goal Beliefs “which expresses actions or states desired or not by the individual”, and 4) General Beliefs (others and reality) that addresses “information concerning others and the environment”(Casakin & Kreitler, 2010). The responses can be regrouped into two factors (Focus on Oneself and Focus on the External World) and eleven themes.

		BELIEF TYPES (4)			
		Self Beliefs	Norm Beliefs	Goal Beliefs	General Beliefs
THEMES (11)	Self Development	XX	X	XX	X
	Inner World Emphasis	X	X	X	X
	Inner Directedness	X	X	X	X
	Contribution to Society	X	X	X	X
	Awareness of Individuality	XX	XXX	XX	XX
	Freedom in Acting	X		X	X
	Restricted Openess to the Environment	X	XX	X	X
	Conditions of Uncertainty	X	XX	X	X
	Demanding from Oneself	XX	XXX	XXX	X
	Self Expression		X	X	X
	Non-functionality	XX	XX	X	XX

FACTORS (2) Focus on Oneself Focus on External World X= number of questions

Figure 3. *Cognitive Orientation Questionnaire of Creativity Constructs*. Adapted from “*The Structure and Dynamics of Cognitive Orientation: A Motivational Approach to Cognition.*” By S. Kreitler, 2013, *Cognition and Motivation: Forging an Interdisciplinary Perspective*, p.45. Copyright 2005 Cambridge University Press.

The factor of Focus on Oneself is comprised of themes of investing in oneself, expressing oneself with authenticity, perseverance, developing and expressing one’s

thinking and imagination, being aware of one's uniqueness in talent, and having self-confidence in one's abilities. The Focus on External World factor contains themes of contributing to society and community, readiness to absorb from the external environment, acting in specific domains in line with self-established rules, and being ready to act even if functionality is not evident at the beginning of the task. The eleven themes (Fig. 4) intersect the four belief constructs and represent the contents of the motivational disposition.

Self Development	Investing, promotion and guarding oneself
Inner World Emphasis	Identifying, knowing, developing and expressing one's thinking, feeling and imagination
Inner Directedness	Emphasis on one's desires, will and decision, self confidence in one's abilities
Contribution to Society	Concern with contributing something meaningful to the community or society even if it does not involve personal advancement
Awareness of Individuality	Emphasis on oneself as an individual unique in one's talents and way of perceiving, behaving and being, not necessarily due to nonconformity
Freedom in Acting	Need to act at least in specific domains in line with rules and regulations set by oneself rather than by others
Restricted Openess to the Environment	Readiness and need to absorb from the environment knowledge and inspiration coupled with resistance to being overwhelmed and harmed by too much openness
Conditions of Uncertainty	Acting Under Conditions of Uncertainty Readiness to act under conditions of uncertainty concerning the results, with no control over the circumstances, may resemble risk-taking
Demanding from Oneself	Demanding from oneself effort, perseverance, giving up comfort coupled with readiness for total investment, despite difficulties and even failures
Self Expression	Concern with using one's talents and expressing oneself with authenticity and characteristically
Non-functionality	Readiness to act even if functionality is not clearly evident from the start.

FACTORS (2) Focus on Oneself Focus on External World

Figure 4. Table of COQ-CR Themes and Descriptions. Adapted from “Motivation for creativity in architectural design and engineering design students: implications for design education,” by H. Casakin and S. Kreitler, 2009, *International Journal of Technology & Design Education*, 20:477, p.481.

Sub-question 2

For Phase 2 of the explanatory sequential design, data was collected from participants within the bounded case through semi-structured interviews. The purpose of interviewing is to learn first-hand about participants' perceptions who are experiencing the

phenomenon of interest. By establishing a rapport with the participant, the researcher guides the conversation in order to understand the participant's interpretation and meaning of their lived experiences (Savin-Baden & Howell Major, 2013, p. 358).

Only one interview was conducted with each participant, and a semi-structured format was the best choice of interview type as it allowed for the collection of both prespecified data (preset questions and probes) and the opportunity for interviewees to share additional perspectives (Bryman, 2012). For this study, the interviews allowed participants to share individual perceptions of the AD student experience while learning apparel design technologies. In particular, the researcher sought participant perceptions of external and internal motivational factors on their work in general and on a specific project of their choosing.

The interviews were conducted in a faculty office and were digitally recorded and transcribed allowing the researcher to be present and listen to the participant's responses. A total of nine interviews were conducted. Following semi-structured interview practices, four preset questions and two probe questions (Appendix B) were developed, but additional questions were asked "in response to participant comments and reactions" (Bryman, 2012). The preset questions ensured the same relevant questions were asked of all participants, but participants were encouraged to share as much information as they desired. The interviews were not limited in time.

Sub-question 3

The correlational design used to address sub-question 3 compared the COQ-CR scores from the interviewee group with creativity scores obtained using the Consensual

Assessment Technique. Interviewee's COQ-CR scores were analyzed separately from the AD respondent group for this part of the study.

As described in-depth within the review of literature, the Consensual Assessment Technique (CAT) is an evaluation technique used for assessing products' creativity by using independent, subjective judgements of experts from the products' domain (Hennessey, Amabile, & Mueller, 2011). It has been used across a range of disciplines and is well validated in the literature (Baer, 2015). Creativity assessments made using CAT more closely mirror real-world assessments as the judges must have experience with the domain being judged (Amabile, 1982). The protocol requires the individuals being assessed for creativity all complete the same task, and the product of that task is evaluated for creativity by an expert panel.

Expert panel selection. The expert panel is formed of individuals with experience in the knowledge domain (Hennessey et al., 2011). Selection criteria for expert panel membership for this study were a minimum ten years of experience in the apparel industry, experience either as an apparel product designer or working with apparel product designers, and availability to complete the evaluation of student work within the timeframe for this study. There is some disagreement in the literature as to the ideal number of judges to use. In Cseh and Jeffries (2019) critical evaluation of the CAT, they present a summary of the technique from a variety of researchers who have used various numbers of judges ranging from as few as two to as many as 134. They further suggest that using more than ten judges could increase the likelihood of a Type I error (false positive) on interrater reliability while using fewer than five judges could increase the chance of both Type I and Type II (false negative) errors (Cseh & Jeffries, 2019). Initially, three judges were selected who completed

their reviews between December 19, 2019, and January 8, 2020. After reviewing the Cseh and Jeffries article, two additional judges were added in March 2021.

All judges had more than the minimum 10 years of experience and were currently working as a designer at the time of the study. Four judges were female and one was male. Three judges worked in the athletic apparel sector, one in graphic design, and was a freelance designer. Three judges were located in Portland, OR, one in Pittsburgh, PA, and one near Nurnburg, Germany. All were former work colleagues of the researcher. Due to their extensive experience as designers, they represented a range of product expertise from infant to adult, athletic to fashion, and denim to performance apparel.

Assessment. The Interviewee group completed a final project in their apparel technology design course guided by the following design brief:

Design a New Closure Device for a wearable for someone who lacks fine motor skills. Loss of manual dexterity and mobility can occur from a range of causes including illness (i.e. Parkinson's disease, stroke), injury, and aging. The ability to dress oneself contributes to an individual's sense of confidence and autonomy and is critical for living without a caretaker. Choose a common wearable and re-envision how a wearer may put the item on and close the opening. Designers can use one or all of the technologies (3D printing, laser cutting, or e-textiles) covered during the course and include skills and abilities from outside the course.

The experts were geographically dispersed and required an online platform for the CAT evaluation. An online CAT survey was created using Qualtrics that included the design brief, images from the students' final project submission, and a brief description of each project. A 5-point ordinal scale evaluation rubric was developed for the expert panel for the

evaluation of creativity as well as aesthetic appeal and technical proficiency. CAT protocol encourages assessments on other product dimensions rather than only using the creativity dimension (Hennessey et al., 2011). The rubric ensured that expert panel members were using the same evaluation criteria and a consistent assessment scale. Per CAT guidelines, the judges completed their assessments independently, and products were presented in a randomized order for each judge. Judges were instructed to rate the projects relative to one another and not compared to an outside standard. The following instructions were provided to the judges:

Review and evaluate each student project relative to one another and assign a creativity, aesthetic appearance, and technical score. A high score of 5 indicates high levels of the dimension are present in the project. A low score of 1 indicates minimal levels of that dimension are evident in the project.

A score of zero was not an available choice on the scale.

Methods of Analysis

Sub-question 1: What constructs contribute most to perceptions of motivations for creativity for apparel design students and how do these constructs differ from students in related design disciplines?

Since a sample of convenience was used for the survey, a descriptive analysis of COQ-CR survey results was selected for the data analysis. Convenience samples reduce the ability to generalize the results to the population being studied. Therefore, inferential statistics were not appropriate for the analysis.

Mean scores for factors, themes, and beliefs were evaluated for each group. Summaries with graphical analysis are presented for each construct to explain which factors,

themes, and beliefs were the highest scoring and therefore the more impactful motivational constructs. Standard deviations are also included as a measure of dispersion for group mean scores. Factor, theme, and belief mean scores were compared to each group to discern similarities or differences.

Sub-question 2: How do apparel design students perceive external and internal motivation factors for creativity in the context of an apparel technology course?

Audio interview recordings were transcribed using the online transcription service, Trint. The transcription was coded using a combination of open and axial coding and used constant comparison until no new themes emerged (Savin-Baden & Howell Major, 2013, pp. 422–424). Open coding is an initial coding process where the researcher conceptualizes the data one line at a time (Savin-Baden & Howell Major, 2013, p. 422). Axial coding takes the incidents from open coding, categorizes these results into themes and then into a frame that suggests relationships between the themes (Savin-Baden & Howell Major, 2013, p. 424). As suggested by Savin-Baden and Howell Major (2013, p. 438), domain analysis was used to group existing themes into symbolic categories. Using a constructivist paradigm, themes and categories relevant to the research questions were identified and interpreted to more deeply explain apparel design technology student perceptions. Interpretation uncovers meaning and can be framed by existing theories and literature to guide the researcher's interpretation (Savin-Baden & Howell Major, 2013, pp. 451–468).

Sub-question 3: What is the association of motivations for creativity constructs and apparel technology project creativity scores?

COQ-CR factor, theme, and belief survey responses were scored for the Correlation Group to determine if they were representative of the larger AD group. Interrater reliability

of experts was evaluated before the calculation of creativity scores for each participant. Creativity scores were correlated with factor, theme, and belief scores using the non-parametric Spearman Correlation Coefficient.

CAT literature recommends the use of Cronbach's alpha to assess interrater reliability (Hennessey et al., 2011). While Cronbach's alpha is used as the test of inter-rater reliability in many CAT studies, there appears to be little justification in the literature for its prevalence (Cseh & Jeffries, 2019). Measures of reliability assume that the measurements being analyzed are measuring the same construct and that each item is composed of a true score plus error (Leech, Barrett, & Morgan, 2015). Leech, Barrett, and Morgan (2015) recommend using Cohen's kappa with nominal categorical variables when raters' scores are using the same codes or values. Cohen's kappa also corrects for the probability of chance agreement by the raters. However, it can only compare two raters at a time. Fleiss' kappa extends Cohen's kappa across more than two raters (Laerd Statistics, 2019). The assumptions for Fleiss' kappa are that the outcome variables are categorical (either nominal or ordinal), the outcome variables have exactly the same categories, and the raters are independent. The results of the CAT meet the assumptions for the use of Fleiss' kappa since the CAT evaluation scale is ordinal, the judges are using exactly the same categories for each dimension, and each judge is independent. The interrater reliability was computed for each of the three dimensions.

COQ-CR scores were correlated to the CAT scores to determine the association of factors, themes and belief with creativity scores. Due to non-normal distributions of one of the constructs, the Spearman Correlation Coefficient was used to correlate COQ-CR

construct scores with judges scores for creativity. This correlation technique assumes that both variables are measured on an interval scale or ratio scale (Cronk, 2014, p. 48).

Data Management

All data collected was stored in a locked cabinet in a locked faculty office or on a password-protected computer. Identifying data was removed on the COQ-CR surveys except for those who were in the Interviewee group. The interviews and final design projects used in the CAT were identified by participant for analysis. Participant identifying data for final design projects was removed prior to judge's review. Judges identifying data was removed prior to using their CAT results for analysis.

CHAPTER 4

Findings

Apparel design students are preparing for careers in an industry that is rapidly changing and embracing new ways of working using new technologies. Recent research highlights the importance of preparing future apparel industry employees with relevant skills (Cole, 2020). In order to do this, it has also been found that apparel design education programs need to evolve (Faerm, 2012, 2015). Understanding the motivational factors of the apparel design learner is a critical starting point to developing better ways to engage and prepare students, and to inform the creation of relevant curricula.

The purpose of this study was to contribute to a deeper understanding of motivations for creativity factors of apparel design students in an apparel design technology context by identifying and explaining motivations for creativity constructs. Both quantitative and qualitative research methods were used to answer the central research *question: What are apparel design student perceptions of motivations for creativity within an apparel technology context and do these perceptions have an association with creative output?* The sub-questions included (1) what constructs contribute most to perceptions of motivations for creativity for apparel design students and how do these constructs differ from students in related design disciplines; (2) how do apparel design students perceive external and internal motivation factors for creativity in the context of an apparel technology course; and (3) what is the association of motivations for creativity constructs and project creativity scores?

Participants

Multiple groups were used for this study. Three knowledge domain groups of students completed the COQ-CR survey: apparel design, interior design, and costume

design. Two sub-groups of the apparel design COQ-CR group formed the Interviewee Group and the Correlation Group.

Survey Groups

To address research sub-question 1, a cross-sectional survey design was implemented. One hundred and sixty responses were submitted following the invitation to complete the survey request. Seventy-eight responses were removed due to incomplete answers leaving 82 records ($n=82$). Incomplete was defined as not enough data to complete at least two of the four belief types and abandoning the remainder of the survey or providing the same response to the majority of questions and then abandoning the survey. Five groups emerged from the usable survey responses: 37 records formed the apparel design (AD) group, 6 records formed the costume design (CD) group, 34 records formed interior design (ID), 4 participants selected Other, and one participant left the group field and the remaining demographic questions blank. The Other group participants were responses from schools selected for apparel design programs, so those responses were added to the AD group. The participant who left the group field blank was from a school whose Interior Design program was selected for the survey. This record was deemed usable as the participant had completed the belief questions, and the record was assigned to the ID group.

One AD record is missing responses for Belief 4. This record was retained for analysis since the other three belief factor responses were complete. Two ID records were missing responses for a belief factor and were also retained for analysis for the same reason as the AD record. There were no missing records in the CD group.

The final group numbers used in the analysis are:

- Apparel Design (AD; $n = 41$)
- Interior Design (ID; $n = 35$)
- Costume Design (CD; $n = 6$)

Seventy-four participants were female (91%), six were male (8%), and one identified as other (1%). Seventy-seven percent of the participants were upper-division students with 25 juniors, 29 seniors and 10 who were in their fifth year. Freshman, sophomores and one undisclosed year make up the remaining 23%. The average age was 22.5 with a range of 18 to 61 years (18 to 61 years) with the majority clustering at 20 to 22 years of age. The average GPA was 3.4 with a range of 2.0 to 4.0. Whites formed the ethnic majority of the participants at 76.8%, followed by Asian and Other each at 8%, and Black or African American at 2%.

When the participants are described by group membership, there are similar distributions of the demographics with the exception of the Costume Design group, which only contains upper classmen and one ethnic group.

Table 2
Discipline Group Demographic Data

Group	Student Level		Gender			Age	GPA	Ethnicity
	Junior/Senior 5 th year	Frosh/ Soph	Female	Male	Other	median	median	
AD <i>n</i> =41	80%	20%	90%	7%	3%	22.5 (range=43)	3.32	66% White 17% Other 12% Asian 5% Black
ID <i>n</i> =35	68%	29%	100%	0%	0%	20.5 (range=6)	3.44	86% White 8% Asian 6% Other
CD <i>n</i> =6	100%	0%	50%	50%	0%	28.1 (range=41)	3.65	100% White

Interviewee Group

To address research sub-question 2, a select group from the those who completed the COQ-CR survey were identified and invited to be interviewed about their perceptions of motivations for creativity. Criteria for group membership was to be an apparel design student, have completed an apparel design technology course including the final apparel design technology project, and have completed the COQ-CR. The total Interviewee Group membership was nine.

Interviews were collected over a 2-year period with six students interviewed in 2017 and three interviewed in 2018. Considered a bounded case, the Interviewee group consisted of five students who were Juniors, three who were Seniors, and one who was taking the course after graduating. Three participants were 20 years of age, two were 21, one was 22,

and three were 24. Seven students identified as female, one as male, and one as other. Seven participants reported their ethnicity as white, and two reported as other. Seven participants reported their GPA's which ranged from 2.9 to 3.62 with a mean of 3.31. Two students did not report their GPA's.

Correlation Group

To answer research sub-question 3, a group of ten apparel design students were selected who had completed an apparel design technology course including the final apparel design technology project and who had completed the COQ-CR. The Correlation Group consisted of one sophomore student, six students who were Juniors, and three who were Seniors. One participant was 19 years of age, five were 20, one was 21, one was 22, one was 24, and one was 60. Nine students identified as female, and one as other. Nine participants reported their ethnicity as white, and one reported as other. All participants reported their GPA's which ranged from 2.9 to 4.00 with a mean of 3.45.

Data

The data used to address research sub-question 1 was obtained from the Survey Group's COQ-CR responses (Appendix A). Descriptive statistics were generated, construct scores were calculated, and bar charts were created in order to provide an overarching description of motivations for creativity for participants in the AD, ID, and CD sub-groups. The data used to address research sub-question 2 came from the individual interviews conducted with each of the Interviewee Group members. Interviews were analyzed for themes and then the themes were grouped into categories. The findings from the interviews further explain the motivations for creativity data obtained from the COQ-CR survey responses. The data used to address research sub-question 3 was composed of scores from

each member of the Correlation Group. The first set of scores came from participants' factor, belief, and theme scores as calculated from their responses to the COQ-CR survey. The second score for each Correlation Group member was a creativity score reported by five judges who judged the level of creativity involved in the final project produced during the apparel technology course. Creativity scores were obtained using the Consensual Assessment Technique (CAT) and were correlated with the COQ-CR belief, theme, and factor scores to determine if there was any relationship between COQ-CR scores and the judged creativity scores.

Sub-question 1

To determine which constructs contributed most to motivations for creativity for participants, the results of the COQ-CR survey were analyzed using descriptive statistics that measure general tendencies in the data, the spread of score, or a comparison of the relationship of one score to others (Creswell, 2012). The COQ-CR survey contained 59 item statements using a 4-point Likert type response scale. The response scale required participants to indicate whether they strongly agree, agree, disagree or strongly disagree with each statement (see Appendix A). The responses were coded as follows: Strongly Agree = 4, Agree = 3, Disagree = 2, and Strongly Disagree = 1. Mean scores were used as a measure of central tendency while standard deviations are provided as a measure of score dispersion. Means and standard deviations for factors, beliefs, and themes were calculated for each discipline group and are presented in tables and bar chart form.

Factors. Across the AD, ID, and CD groups, all have similar scores on the two factors of Focus on External World and Focus on Oneself (Figure 5). The AD group scored 2.80 on Focus on External World and 2.72 on Focus on Oneself. The ID group had the

lowest score on the External World factor with a score of 2.75 and scored 2.70 on the Focus on Oneself factor. The CD group scored slightly higher than the AD group on the Focus on the External World Factor with a score of 2.89 and scored similarly to the other groups on the Focus on Oneself factor with a score 2.71 on the Focus on Oneself factor.

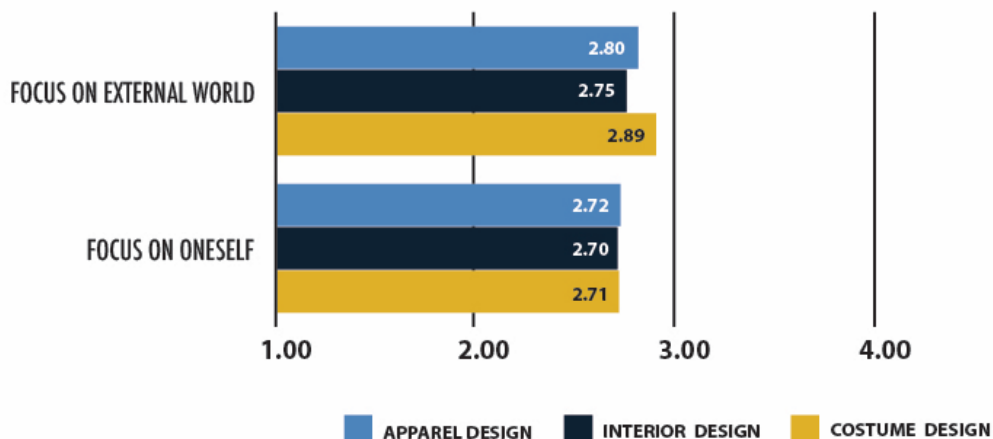


Figure 5. COQ-CR Group Factor Score Bar Chart

Means and standard deviations are presented in Table 3. Standard deviations show that the dispersion of scores is very narrow for each group.

Table 3

COQ-CR Mean Factor Scores and Standard Deviations by Discipline Group

Factor	AD Group <i>n</i> =41		ID Group <i>n</i> =35		CD Group <i>n</i> =6	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Focus on External World	2.80	.16	2.75	.20	2.89	.26
Focus on Oneself	2.72	.13	2.70	.15	2.71	.11

Themes. When reviewing the theme scores with the group scores nested, all themes appear to have scores that are fairly close to one another with the majority of scores by group falling between 2.5 and 3.0.

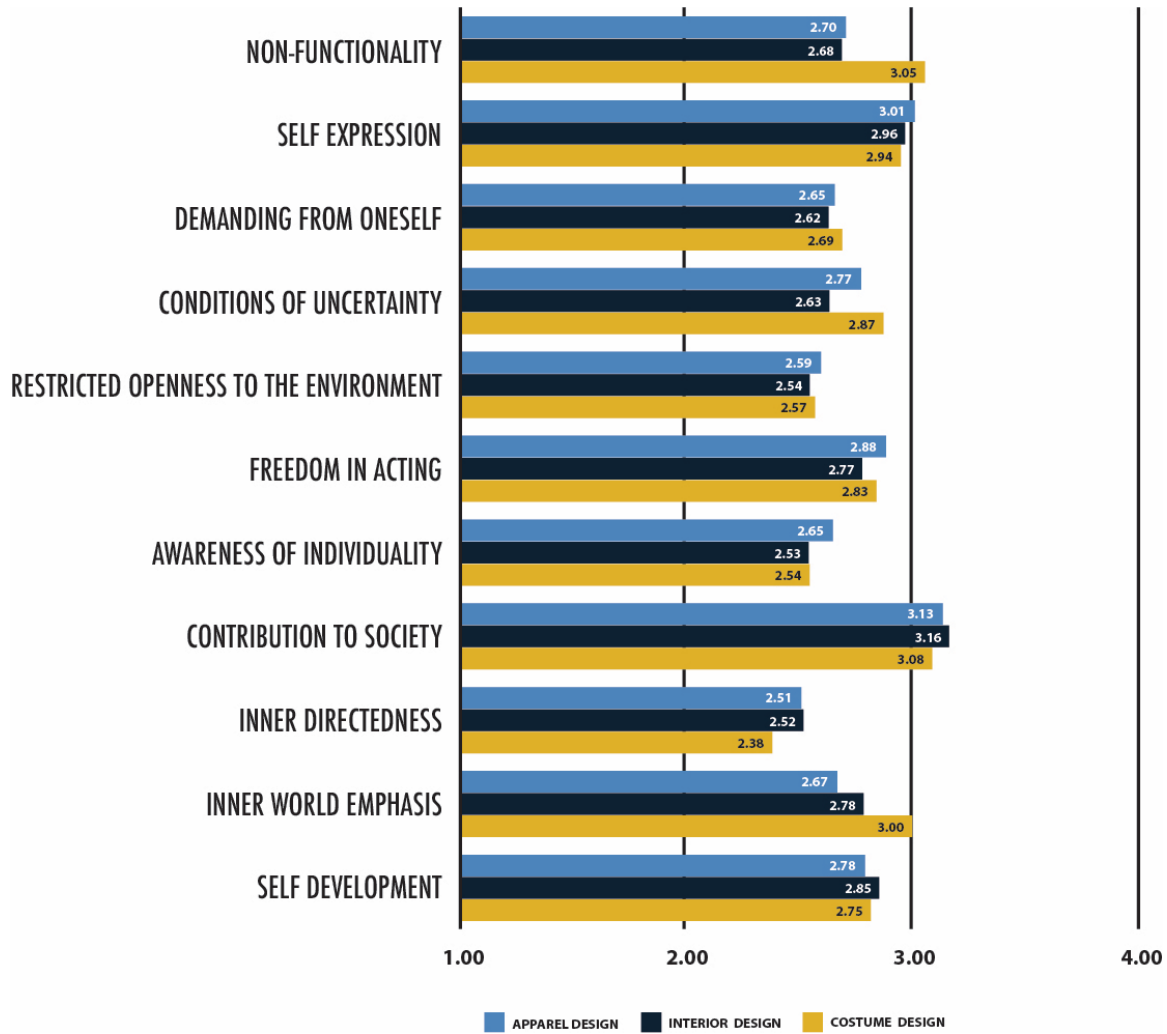


Figure 6. All Groups COQ-CR Theme Scores

Means and standard deviations are presented in Table X by group by theme. Standard deviations show that the dispersion of scores is very narrow for each group.

Table 4

COQ-CR Mean Theme Scores and Standard Deviations by Discipline Group

Theme	AD Group <i>n</i> =41		ID Group <i>n</i> =35		CD Group <i>n</i> =6	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Non-functionality	2.70	.41	2.68	.35	3.05	.38
Self-expression	3.01	.31	2.96	.35	2.94	.33
Demanding from Oneself	2.65	.25	2.62	.17	2.69	.08
Conditions of Uncertainty	2.77	.32	2.63	.44	2.87	.39
Restricted Openness to the Environment	2.59	.46	2.54	.33	2.57	.41
Freedom in Acting	2.88	.46	2.77	.45	2.83	.35
Awareness of Individuality	2.65	.22	2.53	.22	2.54	.13
Contribution to Society	3.13	.39	3.16	.39	3.08	.44
Inner Directedness	2.51	.39	2.52	.32	2.38	.21
Inner World Emphasis	2.67	.36	2.78	.37	3.00	.32
Self Development	2.78	.25	2.85	.29	2.75	.17

Bar charts containing themes are presented by each group with themes sorted from highest to lowest score. All three groups have the same first and last themes. There are

differences in theme order (scores) between groups on the interleaving themes. Blue bars represent themes that form the Focus on External World factor and gold bars represent the themes from the Focus on Oneself factor.

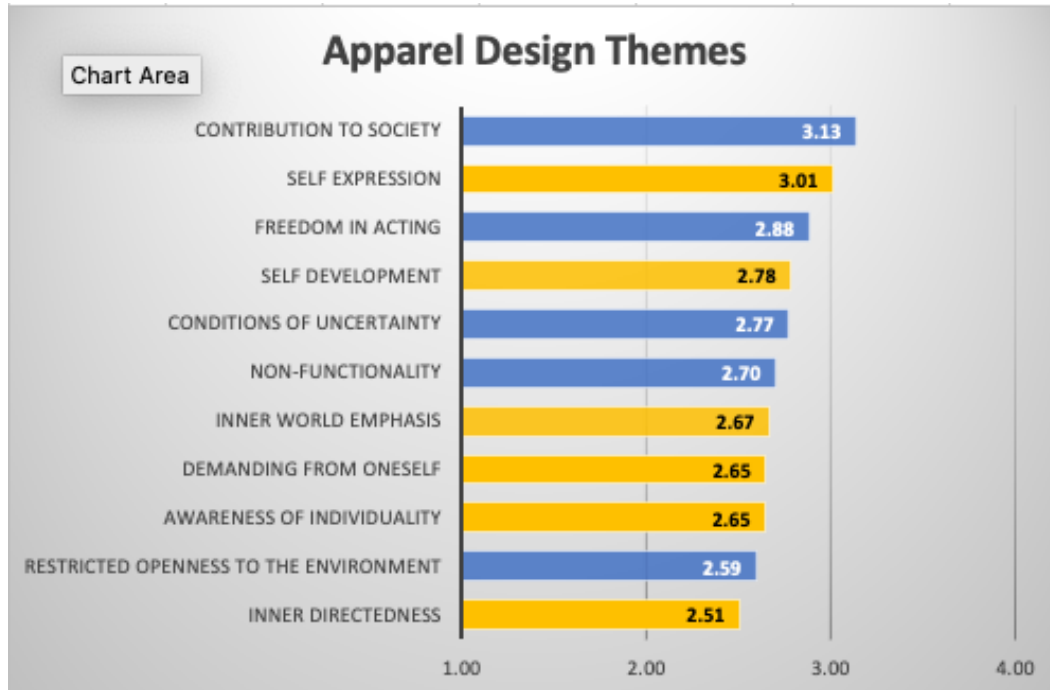


Figure 7. Apparel Design Group COQ-CR Themes

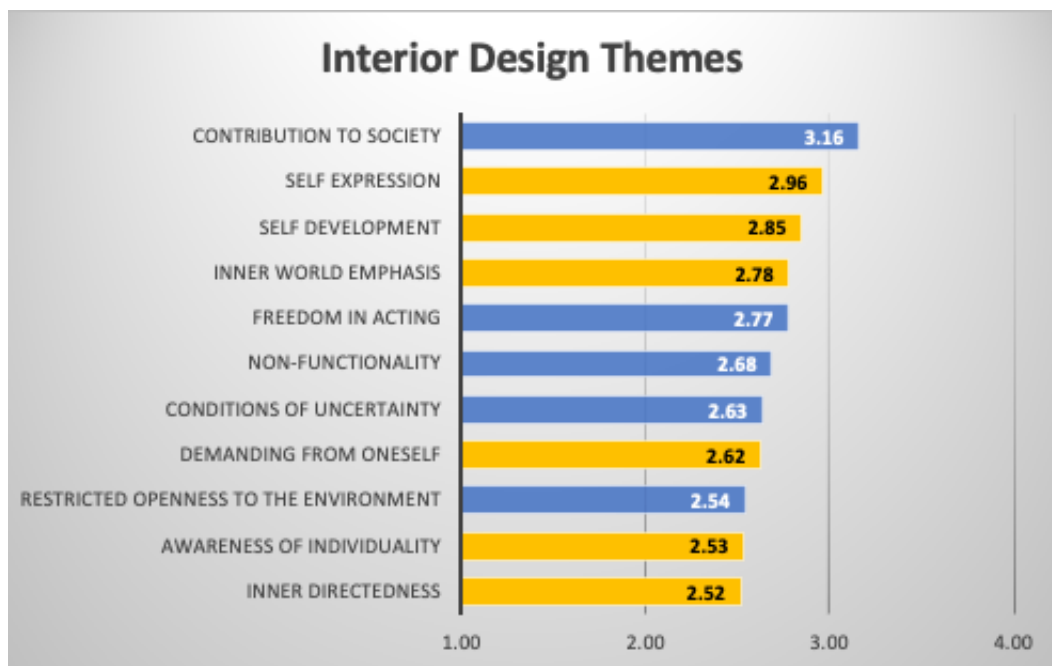


Figure 8. Interior Design Group COQ-CR Themes

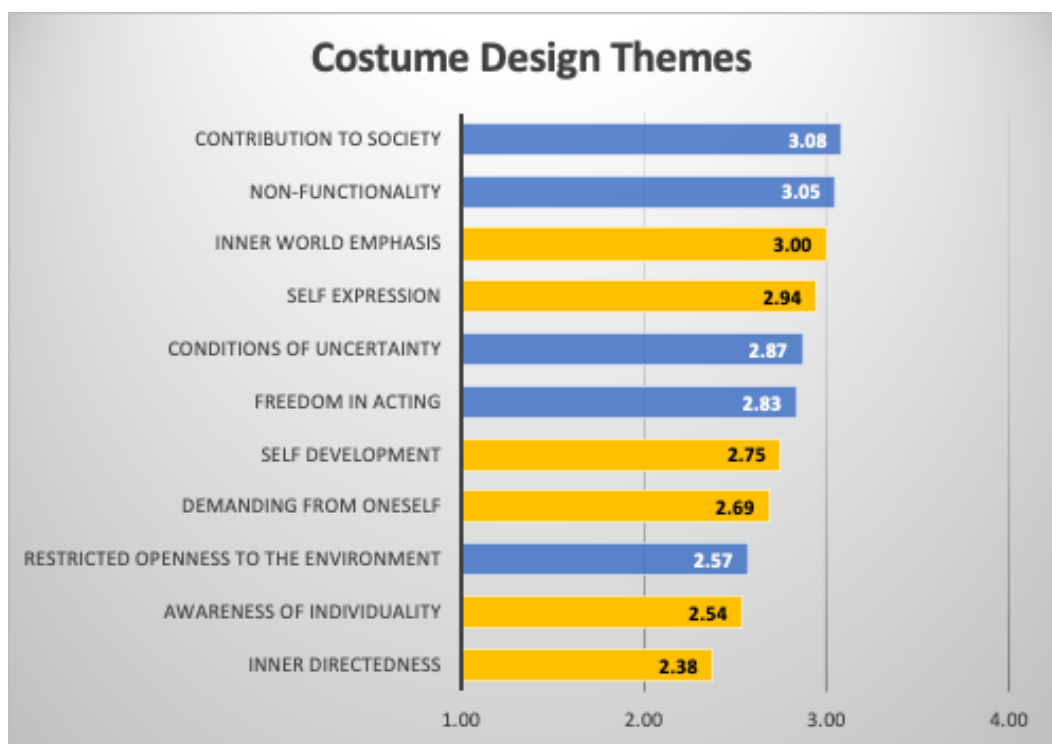


Figure 9. Costume Design Group COQ-CR Themes

Beliefs. All groups scored similarly on the belief constructs. The scores for Self Beliefs were the highest score across all groups, followed by Goal Beliefs, then General Beliefs, and finally Norm Beliefs (Figure 10).

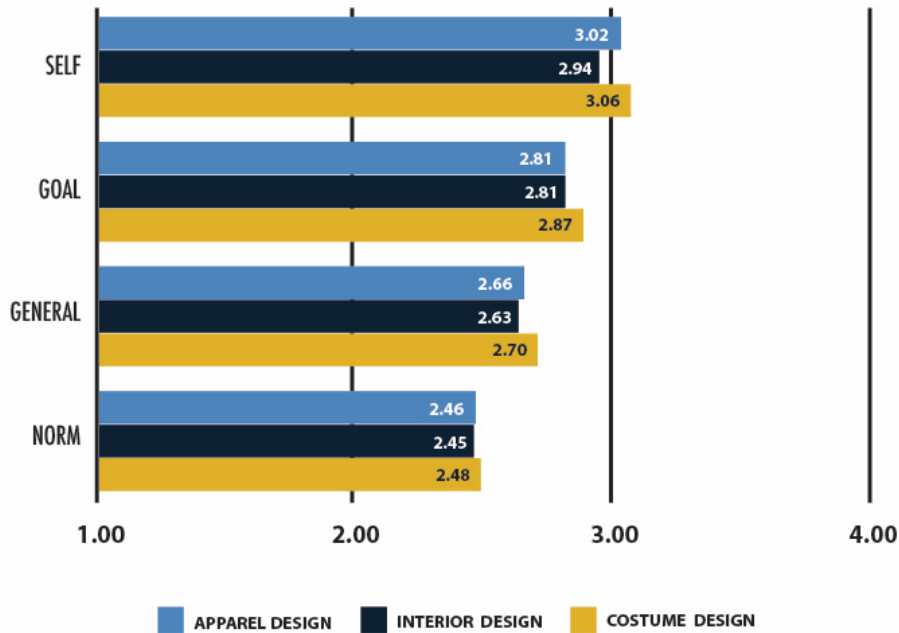


Figure 10. All Groups COQ-CR Beliefs

Group means and standard deviations are presented in Table 5. Standard deviations for all group scores show a narrow dispersion of values.

Table 5

COQ-CR Mean Belief Scores and Standard Deviations by Discipline Group

Belief	AD Group <i>n</i> =41		ID Group <i>n</i> =35		CD Group <i>n</i> =6	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Self	3.02	.26	2.94	.24	3.06	.27
Goal	2.81	.16	2.81	.20	2.87	.18
General	2.57	.16	2.51	.16	2.59	.12
Norm	2.47	.18	2.45	.15	2.15	.08

Sub-question 2

In order to understand external and internal motivation factors among apparel design technology students more clearly, semi-structured interviews were conducted with the Interviewee Group (*n*=9). The Interviewee Group is a subset of the AD Group used in Sub-question 1 and were students enrolled in an apparel technology course. Interviews focused on student perceptions of external and internal motivation factors as they completed design projects using the various technologies that were part of the course.

Following an interview protocol, students were asked to describe motivation and to explain how they knew when they were motivated. They were then asked if motivation came from within or from an external phenomenon and why they were motivated to take an apparel design technology course. Finally, they were asked to reflect on one of the design projects and describe how they solved the corresponding design problem and their quality of work. (Appendix B).

The apparel technology course contained four projects. Students completed three projects using each of the technologies: (a) laser cutting, (b) 3D printing, and (c) eTextiles and self-selected the product type and consumer. For the fourth and final project, students were required to design a new closure device for a wearable for someone who lacks fine motor skills and could use one, two, or all of the technologies combined with skills learned in other apparel design courses.

Interview transcriptions were analyzed for themes using constant comparison until no new themes emerged. Using axial coding, domain knowledge, and CO theory as a context, the themes were grouped into two categories: internal and external.

Internal interview themes. The internal category themes are centered around the self or internal drivers (Table 6). The first three Internal themes generated the most statements from participants with most participants commenting multiple times on *Passion and Drive*, *Interest and Curiosity*, and *Striving for Quality Work*.

Table 6

Internal Interview Themes

Theme	Description
Passion and Drive	Students described internal forces that compelled them to continue thinking, working, and completing projects.
Interest and Curiosity	Students' limited knowledge of design technologies drove their curiosity and personal interest as they wanted to know how these technologies could be integrated into apparel design.
Striving for Quality Work	Students desired a high-quality outcome for their projects and would continue to iterate prototypes until a high level of quality could be achieved.
Perseverance and Personal Growth	Students described personal growth through solving design problems by entering periods of difficulty followed by feelings of reward and self-satisfaction.
New Opportunities and the Future	Students' willingness to learn apparel technology was contextualized by the future of technology and desire to stay current from a professional perspective.

Passion and Drive. This theme encompasses internal forces that compelled the participants to continuously think, plan and work on their design projects. Most students used the words *passion* and *drive* to describe motivation with an orientation toward a goal or an outcome. Ellie defined motivation as “an idea that drives people to do something they really want to or wish to do,” while Chris described both passion and drive as attributes from within a person that are present when in pursuit of “something that you care about.”

Several students described being motivated as thinking about the design project frequently and considering design solutions or resolving problems even when they were not

actively working on their project or in a classroom setting. Krista coupled frequent thinking and planning with steady progress toward achieving the goal and described her thought process as "... you're actively thinking about the progression of the [project]... you're thinking about things that you could purchase, create, draw... Towards your end goal at a constant upward pace." Sarah talked specifically about prioritizing the design project over other events in her life and "making sacrifices" in order to pursue passions or interests. Mary viewed the absence of the feeling of need to continue working on a design problem as a sign of lack of motivation and stated, "[if] you're passionate about something, you want to continue working on it. If you don't feel the motivation to keep working on it, then it's kind of like you give up on the project essentially."

Students mentioned positive feelings of excitement or happiness when describing the passion that motivated them toward a design project. Ellie characterized the presence of motivation as truly loving the project that you are working on and described "sparks" when she realized her proposed idea was going to work and became very excited during the interview as she explained this feeling.

Two students make it clear that they were not seeking an external reward for completing a project. Ellie said that she did not look for rewards but rather "a good feeling" from within herself. Julie also distinguished between internal drive and external rewards and stated that "not all rewards [are] worth something [that] will add to yourself. You just do it for your personal thing."

Interest and Curiosity. When describing motivation, interest and curiosity appeared frequently in student comments. These words were used again when students were asked why they enrolled in an elective apparel technology design course. Students typically used

the word *curiosity* when they were not yet enrolled in the course and did not know much about the technologies or were not clear on how these technologies integrated with apparel. The word *interest* was used when students had acquired domain knowledge of the topic being discussed.

When using the word interest to describe their motivation, students described a willingness to invest time and effort to pursue an interest. In the previous theme, students described project thoughts as occupying much of their thinking. The same process was also described with the apparel technologies that interested them. As a general comment about interest, Brenda shared that if she was really interested in a subject, she would think about it frequently during her free time. When prompted about their motivation for enrolling in the apparel technology course, Brenda and Mary said they thought the class content sounded “really interesting” but were unsure how they would use the technologies. As Brenda learned more about the technologies, she was able to envision how content could be used and developed a deep interest in laser cutting and its use in her area of interest of high fashion. Krista described her interest in the class as less about apparel and more about the opportunity to try new technologies and challenge herself. Her quote summarizes her early feelings of self-doubt while acknowledging interest in the subject, “Wow! I’ll never be able to be that cool or design something that interesting from my own brain and like literally print it and make it happen”. Being able to use apparel technologies to create was a main reason for Krista to enroll in the apparel technology course. She summarizes her decision to take the course by stating, “it wasn’t a question [whether or not to take the class]. As soon as I found out it was available... this was one that I made it [fit] into my schedule.”

Most of the curiosity comments stemmed from the newness of the technologies and limited knowledge of how these technologies could be integrated into apparel design. Julie had heard complaints from students previously enrolled in the apparel technology course and was curious to know why they were complaining and enrolled in the course to find out for herself. Sarah was curious about the incongruity of technology and apparel and shared as her reason for taking the course-- “it was different than other classes we had. And I just thought it was really cool like my fashion design major. Not an engineer, not the electrician.” Kelsey also echoed the Sarah’s curiosity about technology and apparel coming together:

I took this class because it was new and interesting, and I never really heard of it.

Any [of the technologies] that were in it, I kind of knew about, but I never heard about it being used in apparel, so it was really fascinating. I'm going into the outdoor industry, [and] I see a real use for it.

Some students described a curiosity to try to use the technologies. Mary shared a hesitancy in her self-confidence in using the technologies after seeing a presentation from the previous year’s students and prior to her own enrollment in the apparel technology course. During her interview, she said her thinking at the time was “...maybe I could try to do something similar, [but] I'm not sure if I [can] accomplish that.” However, her curiosity overrode any hesitancy that would have made her not enroll in the course.

Striving for Quality Work. Most participants described an intent for a high-quality outcome either in general or when specifically asked about their individual projects. All interviewees expressed a desire to continue developing projects in pursuit of better quality or better function. When defining motivation, Brenda included a reference to quality level, and

described motivation as “something that you're passionate about. Motivation is kind of the feeling that drives you to do the best that you can in whatever it is you're doing.”

Most students spoke of their drive to go beyond the scope of the project. Sometime this desire was in response to the question asking them to describe the quality of their work. Other times this information emerged during the interview and was not related to a particular question. In many cases, students described very specific design improvements. Some students acknowledged that there were quality limitations due to lack of experience using the technologies. Chris recognized that her project using 3D printing directly onto fabric wasn't “100% perfect because I haven't worked with [3D printing] for that long,” but felt that the resulting garment was of a high enough quality for wearing that she would have been proud to show it to people. Mary specified coordinating products that she would have liked to produce in addition to her 3D print project. When asked to describe a project from the course, Mark chose to discuss a less successful laser cutting project and describe material and process improvements. Julie also discussed material improvement and better integration of technology into her eTextile project and cited inadequate funds as the reason for her project utilizing lower quality fabrics and fewer eTextile components. Ellie, who graduated the previous semester, characterized her drive as challenging her to see how much she was capable of doing. She articulated a desire to take her final project that utilized laser cutting further than what time permitted during the course and specifically wanted to do product testing to determine if her final project truly functioned.

Perseverance and Personal Growth. This theme addressed the challenges associated with design problem solving and the personal growth and sense of accomplishment that emerged upon the completion of a design project. Participants described periods of difficulty

followed by feelings of reward and self-satisfaction. This sense of drive mentioned in the Passion and Drive theme also appeared as a force for helping students move through difficulties in producing a design solution to a project. When Kelsey described how she knew if she was motivated, she voluntarily included comments about pushing through challenges:

I think when you start working on certain projects or things that make you excited... And [the projects] just kind of bring joy to your heart. I think in that way that's kind of when you know you have motivation, or you continue to push yourself even though it's not the best or you're still not getting it right. You continue to push and push and push. I think that's when you know that you have motivation.

Even if challenges or failures were encountered, this internal drive pushed students to continue working toward an end goal. Brenda described a sense of personal satisfaction in reaching a finished product whose process contained difficulties:

It's very satisfying to do something yourself. Once you finish whatever it is that you do, it's just very rewarding to know that you did it. It [can be] really frustrating and almost to the point where I wouldn't want to continue... because I'm [thinking] “well, this is dumb”, and then once you get over the little difficulty... then it's worth it!

As Mary was detailing her challenges with her 3D print project, she expressed her frustration with her output not matching her vision:

...it didn't look like how I was picturing it in my mind. And I feel when I'm drawing things, I want it to look exactly how it looks in my head. And when it's not, I have to redo it multiple times [until] I can get it exactly how I want to see it.

New Opportunities and the Future. Participants perceived the content of the apparel technology course as new and different and was therefore interesting but in a different way than the *Interest and Curiosity* theme previously presented. The interest was in the context of newness, the future of technology, and the desire to develop a current skill set from a professional perspective.

Julie found the newness of the technologies appealing to her when she compared them to traditional approaches for garment creation. Brenda was motivated to learn about apparel technologies because of the newness and the potential and even the unknown:

It's really interesting and there's just a lot that can be done with it that we don't know. There's a lot of testing that we can be doing ... so it's at the very beginning stages. And so this is a new thing on the market and it's exciting to be a part of the beginning instead of just hearing about it later.

Chris had a general interest in the integration of technology into fashion and “where fashion is going in the future”. This interest compelled her to enroll in the course.

When Krista reflected on her professional skill set and reasons for taking the apparel technology course, she thought that participating in the course gave her “a more well-rounded diverse education as far as understanding a little bit about circuits and 3D modeling and printing.”

External interview themes. The external category themes relate to the input of others either through feedback, functional analysis of the end product by others, or group membership (Table 7). Validation from Others was the most prevalent theme in the External category.

Table 7

External Interview Themes

Theme	Description
Validation from Others	Students viewed positive or constructive feedback from others as a motivator.
Functional Products that Help End Users	Students described a desire to create products that helped others or to create products with a purpose.
Group Membership and Collaboration	Students indicated a desire to be part of a group or to interact with other through learning, exchanging ideas, and receiving encouragement.

Validation from Others. Receiving both positive and constructive feedback from others was viewed as a motivator by most participants. Not wanting to disappoint others either in quality or function of final product was also mentioned by several participants. This theme was commented on more than any other theme in the External category.

Several students described specific situations where they received validation from others that their project was successful or usable. Brenda viewed positive feedback from people as affirmation that her idea was valid and that she should continue working. While describing external motivational influences, Krista explained that when she is designing for a purpose and for a consumer she wants “other people to appreciate what [she] is doing”. Ellie explained her excitement about learning about apparel design technologies and wanting to share this information and her designs with coworkers. Sarah recounted sharing her 3D print alternative lingerie closure based with friends and receiving comments:

I felt so cool just being able to model something... even something basic. It's like “oh yeah, I can make that and print it. Or sew a circuit.” I just loved to show my

friends what I was doing and working on this semester in that class, because people were always blown away. [They would say], “that’s so cool!”

In discussing the quality of project output for her eTextiles hat, Kelsey recounted people asking her to make hats for them. She viewed this project as “probably my best project that I’ve done” because of people’s desire to own one of her hats.

Constructive criticism was also valued as a form of validation. Mary acknowledged the role of constructive criticism in combination with positive feedback as a motivator in her project work. Mark explained how he viewed constructive criticism as a form of project validation and stated, “[I can take] constructive criticism, no problem. [I] immediately input that into my final product. Because that means you’ve taken an interest in what I’ve been doing, and that way the idea has some merit already.”

A few students mentioned not wanting to disappoint others with their design projects. Brenda looked to other people for inspiration and for validation of her ideas and described her intent in doing this as “[wanting] to do well so that you don’t disappoint people”. Julie specifically described making things for someone else as a big motivator to being more creative in her design and execution of the final output. There is some overlap with the idea of not disappointing others and the next theme of *Functional Products that Help End Users*.

Functional Products that Help End Users. Participants described a desire to create products that helped others or to create products with a purpose. Sometimes the purpose was directly related to the apparel technology course’s final project of designing a new closure for someone with a disability, but other times the purpose was presented in context with activism. Students were asked to describe one project from the course during the interview,

five of the nine participants chose projects that directly benefitted the end user. When discussing her self-selected 3D print project, Chris explained that her project choices were in response to the idea of women not having control over their bodies in a rape situation. She explained the location of her 3D print design:

I thought of this project kind of like an [inspiration]... putting art on the body and seeing it as like a special way of control, like having control over your body. And so that really is still driving me.

When discussing motivation for her 3D print lingerie closure, Sarah described her reasoning for choosing her consumer and product:

I'm really into feminism and making women feel empowered. Kind of doing things that other people don't expect... thinking outside the box or outside the bra in this instance. Yeah, I think [my project] was representing an underrepresented target market.

When asked to describe one of their projects from the course, Ellie chose to talk about the final project and felt like she learned the most from it because she was “helping another person”. The eTextile project that Kelsey mentioned in the *Validation from Others* theme was a functional product that helped make runners more visible as night. When describing her motivation for the project, she says, “my motivation was [for the hat to] be seen from all directions and still make it useful for the wearer”.

Group Membership and Collaboration. Learning with others and exchanging ideas was described as an external motivator for participants. Group membership offered opportunities for brainstorming, idea validation, and encouragement. Chris recounted working in an environment with other students and seeing “all this great stuff happening” as

being a motivator for her own work. Krista described family and relationships as factors impacting motivation. Sarah used the word “team” to describe people who were supporting her by answering questions and brainstorming ideas while Brenda discussed being a part of a class and learning together. Mark also described collaboration with others as motivational encouragement while Mary suggested support from others as a factor in maintaining her self-motivation.

Ellie, who was a returning student and working full time, liked learning with the other students in the class but felt like an outsider because she did not have any other classes with her apparel technology course peers. She did not feel the sense of community that she did when she was an undergraduate student.

External and internal themes together. Most students acknowledged the role of both external and internal themes on their motivation. In some examples, external and internal themes would be present simultaneously with attributes from an external theme informing an internal theme (Figure 11).

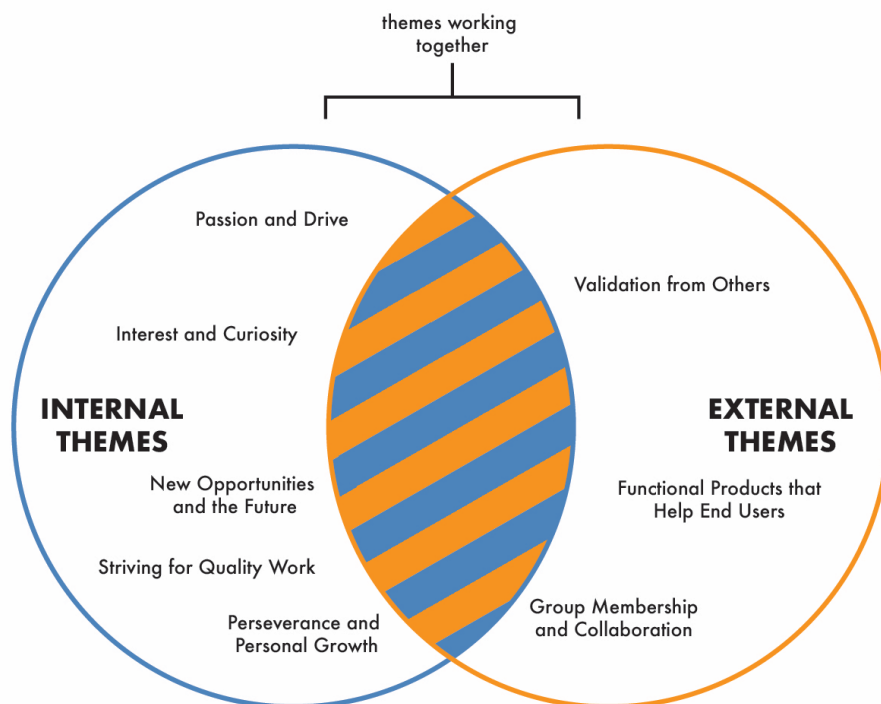


Figure 11. Interview Themes

Chris specifically mentioned being in an environment with other students as a motivator but at the same time is very clear that motivation “also has to come [from] within you”. Early in Krista’s interview she described motivation as a “feeling of drive within yourself to obtain a certain goal” and when prompted, she elaborated on external factors such as “outside environments, family, relationships, the world” that influence her motivation. She described external and internal forces as equal:

It's definitely a balance. I think for it to be healthy motivation, it's got to be a 50/50 thing. It's easy to think you're crazy if there's no outside reassurance of what you're doing, so I think having a good support system and having people motivate with you and lift you up as well [as] having your own goal and your reasoning behind it.

Brenda defined motivation as encompassing forces from within a person and external forces that are an influence or act as inspiration toward her work. When explaining the combination of internal and external influences on motivation, Mary describes other people's words of encouragement as a motivator for her to personally choose to continue work.

Krista recounted the importance of the final project as she encountered a design challenge:

....it just didn't feel complete. this project was important to me because this is one that really felt like [it] had more of a purpose because it was for someone who had either a disability or disease that prevented them [from doing things using] hand dexterity. This is my favorite project to talk about to other people, because it's not just like I made a button because it's pretty, it's like I made a button because I want this to actually work for somebody.

Her above comment includes elements of *Validation from Others* and *Perseverance and Personal Growth* and shows how the themes are not present discretely in students' experiences.

Sub-question 3

In order to determine the association between COQ-CR scores and creativity scores, COQ-CR factor, theme, and belief scores from the Correlation Group ($n=10$) were correlated with judges' creativity scores collected through the CAT. Correlation group factor, theme, and belief scores were reviewed to determine if this sub-group of the AD group scored similarly. The Correlation Group factor scores are not as close as the larger AD group (Figure 12).

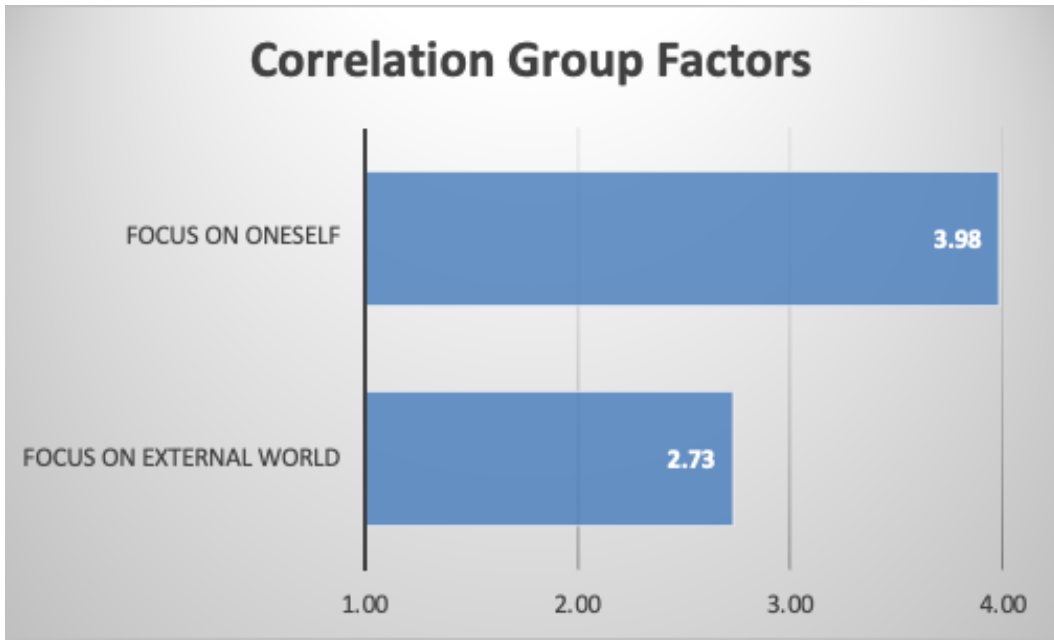


Figure 12. Correlation Group Factors

More emphasis is placed on the Focus on Oneself factor than the Focus on the External World factor by the Correlation Group than the AD Group. However, the scores on themes and beliefs are very similar between the two groups.

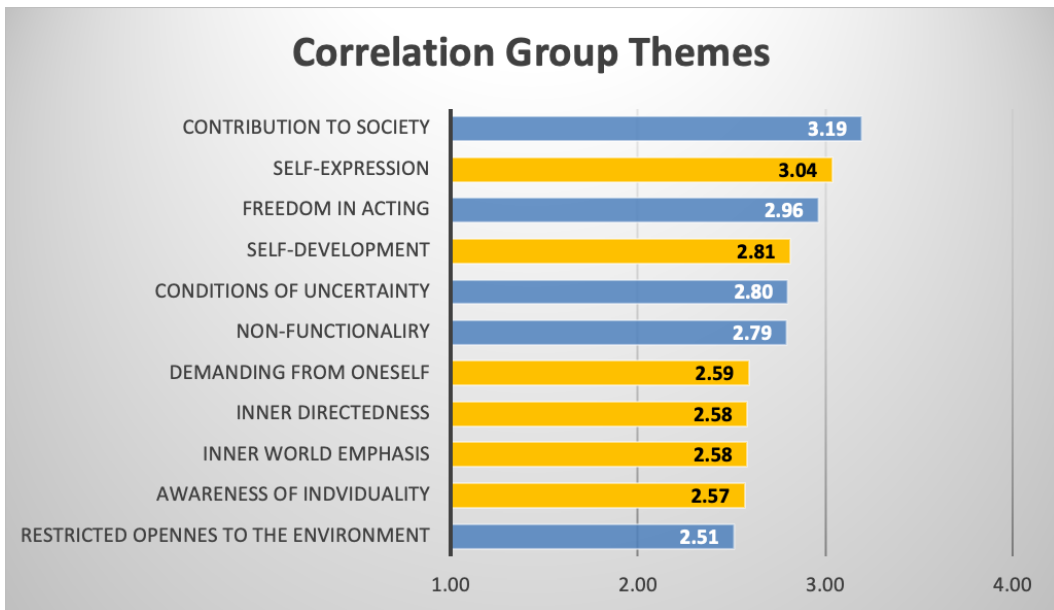


Figure 13. Correlation Group Themes

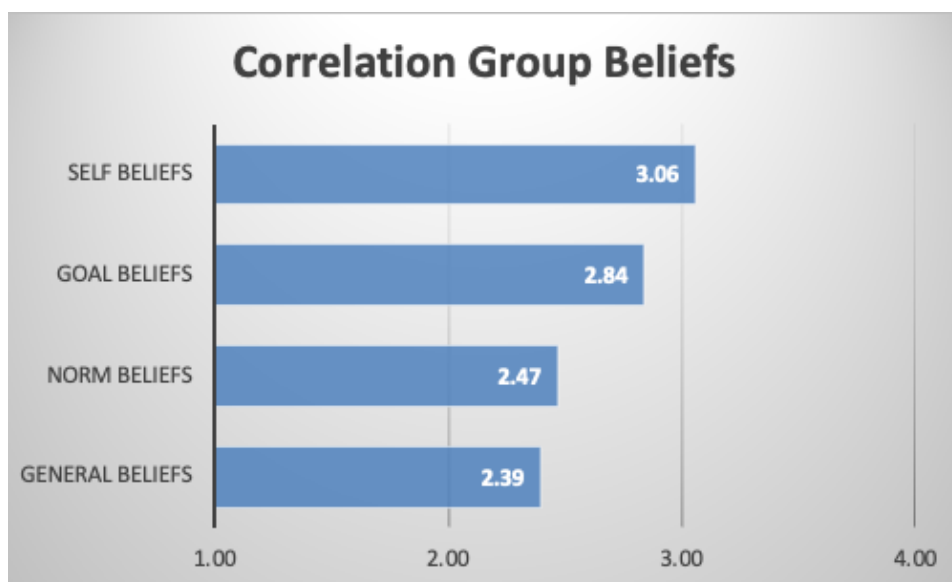


Figure 14. Correlation Group Beliefs

The Correlation Group's top six themes are the same and in the same order as the AD Group. Their highest scoring belief is also Self Beliefs. This would suggest that the Correlation Group is a reasonable representation of the larger AD Group.

Following recommended CAT methods as presented in the Methods chapter, the five judges evaluated participants' projects for creativity, aesthetic appeal, and technical proficiency using a 5-point ordinal scale (1= low to 5= high evidence of construct being evaluated). CAT scores were checked for interrater agreement by using Fleiss' kappa (Table 8). Values above .61 represent substantial agreement beyond chance (Landis & Koch, 1977).

Table 8

Interrater Agreement Using Fleiss' kappa

Dimension	Fleiss' kappa
Creativity	.066
Aesthetic	.017
Technical Proficiency	-.043

Low interrater agreement was found. While the judges were not in agreement with creativity evaluations, their scores were still a usable measure of creativity. A mean creativity score for each Correlation Group member was calculated from judges scores.

Prior to selecting a correlation coefficient, a test for normality was conducted. One of the assumptions for the Pearson Correlation Coefficient is the normal distribution of data.

Due to the small data set, a Shapiro-Wilks test was used to determine normality (Ghasemi & Zahediasl, 2012). General Beliefs deviated significantly from a normal distribution ($p = .03$).

All other data were normally distributed. Due the non-normal distribution of General Beliefs, the non-parametric Spearman Correlation Coefficient was used to determine if there were any correlations between COQ-CR scores on factors (2), themes (11), and beliefs (4) and creativity scores. This study had a small number of participants, and small sample sizes reduce the chances of finding a statistically significant correlation while a very small correlation can be significant within studies that have enough participants (Cronk, 2014).

The Spearman Correlation Coefficient produces a value with a range of -1 to +1 with a value of 0 indicating no association (Cronk, 2014). Rea and Parker (1992) offer these interpretations of the r value:

Table 9

Interpretation of the Spearman Correlation Coefficient

Correlation	r
Negligible	$0.00 < 0.10$
Weak	$0.10 < 0.20$
Moderate	$0.20 < 0.40$
Relatively Strong	$0.40 < 0.60$
Strong	$0.60 < 0.80$
Very Strong	$0.80 < 1.00$

Effect size was also calculated to describe the strength of the relationship between the variables. While the r value from the Spearman Correlation Coefficient can be used alone, it can be squared to create the “ r squared” or coefficient of determination statistic and is used as a percentage of variance of the dependent variable that can be predicted from the variance of the independent variable (Leech et al., 2015) or the proportion of variance in one variable that can be explained by the variance in another (Aggarwal & Ranganathan, 2016). Cohen (1988) offers the following interpretations for effect size (r^2) for use in a small sample, social science context:

Table 10

Interpretation of the Strength of Effect Sizes

General Interpretation of Relationship Strength	r^2
Much larger than typical	.49
Large or larger than typical	.25
Medium or typical	.09
Small or smaller than typical	.01

Leech, Barrett, and Morgan (2015) point out that there is some disagreement among statisticians whether these percentages are accurate or are underestimating the strength of the effect.

Table 11
Spearman Correlation Coefficient Between COQ-CR Constructs and CAT Creativity Scores

Constructs	Degrees of Freedom	<i>r</i>	<i>r</i> ²
Self Beliefs	8	-.30^b	.09
General Beliefs	8	-.20^b	.04
Norm Beliefs	7	-.02	.04
Goal Beliefs	7	.23^b	.05
Focus on External World Factor	7	-.01	0
Focus on Oneself Factor	6	-.10	.01
Contribution to Society Theme	7	-.16	.03
Self-Expression Theme	7	.05	.00
Freedom in Acting Theme	7	.10	.01
Self-Development Theme	7	.35^b	.12
Conditions of Uncertainty Theme	7	.35^b	.12
Non-Functionality Theme	7	.51^a	.26^c
Inner World Emphasis Theme	7	.50^a	.25^c
Demanding from Oneself Theme	7	-.37^b	.14
Awareness of Individuality Theme	6	-.04	.00
Restricted Openness Theme	7	-.56^a	.31^c
Inner Directedness Theme	7	.11	.01

^a*Relatively Strong correlation*

^b*Moderate correlation*

^c*Large Effect Size*

Three relatively strong and six moderate correlations were found (Table 11). The three relatively strong correlations also had large effect sizes. Restricted Openness has a relatively strong negative correlation with creativity scores with a large effect size indicating that 30% of the variance in creativity scores could be predicted from scores on this theme.

The themes of Non-Functionality and Inner World Emphasis were relatively strongly

positively correlated with creativity scores with large effect sizes indicating that each of these themes could predict 25% of variance in creativity scores. Moderate positive correlations were found between creativity scores and Goal Beliefs, Self-Development Theme, and Conditions of Uncertainty Theme. Moderate negative correlations were found between creativity scores and Self-Beliefs, General Beliefs and Demanding from Oneself Theme.

CHAPTER 5

DISCUSSION

The purpose of this study was to investigate perceptions of motivations for creativity among apparel design technology students and to determine if these perceptions had an association with creative output. Due to the broad scope of the research purpose, three sub-questions were developed that further focused the overarching research question and contributed to the study design and data collection methods chosen for the study.

- Sub-question 1: What constructs contribute most to perceptions of motivations for creativity for apparel design students and how do these constructs differ from students in related design disciplines?
- Sub-question 2: How do apparel design students perceive external and internal motivation factors for creativity in the context of an apparel technology course?
- Sub-question 3: What is the association of motivations for creativity constructs and apparel technology project creativity scores?

Sub-question one directed the quantitative Phase I of the explanatory-sequential design. In this phase of the study, an online survey (i.e., COQ-CR) was used to collect general perceptions of motivations for creativity from participants. Sub-question two constituted the qualitative Phase II of the study and utilized interviews with a bounded case to explain the external motivation and internal motivation findings from Phase I. The quantitative results were integrated and interpreted with the qualitative interview findings which supported and clarified the COQ-CR results. The association of motivations for creativity constructs and project creativity scores that form sub-question three will be addressed separately.

Motivations for Creativity Perceptions

Quantitative findings from the COQ-CR indicate that Apparel Design (AD) participants motivations for creativity is influenced by both internal and external factors. Three themes and one belief were found to contribute most to AD participant COQ-CR scores, and these themes and the belief were compared and contrasted with scores from the interior design (ID) and costume design (CD) groups to determine similarities and differences.

The discussion is presented beginning with the broad area of external and internal forces and then is refined to the specific constructs that contribute most to AD participant's perceptions of motivations for creativity. Interview data supports the balanced role of external and internal factors and explains the themes and the belief within an apparel design technology context.

External and Internal

The scores from the COQ-CR would indicate that AD participants acknowledged the role of factors from the external world and factors that focus on themselves equally. The AD group mean scores for the two factors (Focus on the External World = 2.80; Focus on Self = 2.72) had a difference of .08, indicating that this group perceives value in both factors and does not necessarily prioritize one over the other. Participants recognized and valued their own skills and abilities and believed in developing their talents in an individual and authentic way while being receptive to the environment, as long as it didn't infringe upon their self-direction. Factor scores for the ID and CD groups also were very close again indicating a similar perspective on the role of external and internal factors on their motivations for creativity.

The COQ-CR factors of Focus on Oneself and Focus on the External World and the two categories (internal and external) that emerged during the axial coding of interviews should not be confused with the definitions of extrinsic and intrinsic motivation presented in the review of the literature. The Focus on Oneself factor relates to the self's "uniqueness, development, and expression" while the Focus on the External World factor represents "maintaining openness to the environment without endangering inner-directness" (S. Kreitler, 2013). Extrinsic motivation is defined as "the performance of an activity in order to attain some separable outcome" (Ryan & Deci, 2000, p. 71) or an outcome that is not from within the person performing the action such as a reward. Intrinsic motivation is defined as "the inherent tendency to seek out novelty and challenges, to extend and exercise one's capacities, to explore, and to learn" (Ryan & Deci, 2000, p. 70). Tasks done for intrinsic motivation do not have an external reward or external validation and are done for self-fulfillment or personal growth. Both factors on the COQ-CR appear to contain elements related to intrinsic motivation. The qualitative analysis of interviews appears to provide the explanation for these results.

Interview responses from the apparel design technology students supported the role of motivators from within the participant and motivators coming from the environment and others as evidenced by the two categories (internal and external) that developed as axial coding was used to group interview themes. In general, the internal interview theme category focused on internal drivers, personal interest, pursuit of quality, personal growth, and the potential to learn professionally relevant skills. The external interview category contained themes of positive feedback and constructive criticism from others, the creation of products with a purpose, and the benefits of group membership and collaboration. Most

participants acknowledged that a balance was needed between internal and external motivators to stay motivated to complete a project. While several participants described motivation as coming from within, factors such as external stimuli, the environment, and encouragement from others were also described as supporting the internal motivational drive.

Interviewees described feedback from others and the creation of products with a purpose as a collaboration between an external person and themselves, rather than an external evaluation that was motivating them to complete a project in hopes of earning a high grade. One student described taking constructive criticism and putting that information back into his project to continue improving for the next prototype iteration. He indicated that the constructive criticism was not an end goal (like a reward) but feedback along the way that would keep moving his project forward. Although some of the students in the Interviewee Group received validation from their target users on their final projects, not all did. The ones that did receive feedback used this information as an indicator of having met the functional criteria for their project but were still planning on evolving and improving their projects in other ways. It would appear the input from others was used by participants as part of a feedback loop. When asked if an external motivation could be a reward, two students were very specific in their responses by stating that external motivation was not a reward.

While the factors provide a general description of source of origin of motivation, they do not provide specificity as to type or description of motivator. Given the quantitative scores for each of the two factors were nearly the same, the themes and the belief need to be examined more closely to determine highly contributing constructs. Each factor contains

themes that specifically identify the motivators in more detail (Fig. 3, Chapter 3). Beliefs intersect themes and regroup the COQ-CR statements into four belief groups (Fig.4, Chapter 3). A belief contains questions from multiple themes and both factors that relate to the belief content.

Constructs

The differences between the eleven theme scores were not very large between the three groups. After reviewing the theme scores for the AD Group, a natural break in scores was observed between the third and fourth highest scoring themes. Based on this, the top scoring three themes within the AD Group were selected for a more in-depth analysis. For all groups, the top three themes contain themes from both factors and indicate that participants regardless of domain acknowledge both internal and external influences on their motivations for creativity. For both the AD and ID groups, themes one through three had larger mean differences ($MD > .11$) between them, than themes four through eleven ($MD < .1$). The larger mean differences indicate that the first theme influences more than the second theme, and the second theme influences more than the third. The small mean differences in theme scores for themes four through eleven indicate that these themes are contributing similarly to the overall perception of motivations for creativity. The CD group mean differences between their top three themes was less than the other two groups ($MD \leq .05$) indicating a more equal influence of these themes.

Contribution to Society. The top theme for all groups was the Contribution to Society (AD = 3.13, ID = 3.16, CD = 3.08). Part of the Focus on the External World, factor, Contribution to Society addresses the individual's concern with meaningful contribution to community or society without the expectation of personal advancement, investing time and

effort to social causes, and being ready to assist others (Casakin & Kreitler, 2010). It is not surprising to see this theme at the top for all groups as this is a typical attribute of the socially-oriented Gen Z generation (Gomez et al., n.d.; Parker & Igielnik, 2020) who make up the majority of participants in this study. This finding is corroborated by Seemiller and Grace (2016) who found Gen Z undergraduate students typically attempt to positively affect the lives of others.

Apparel design technology interviewees expressed their desire to create products that help others whether through a functional product design or by using their projects in an activist approach. This desire was captured in the *Functional Products that Help Others* interview theme. Although the final project in the apparel technology course was specifically designed as a product to help others, students completed three additional self-selected projects during the course. Interviewees could choose to discuss any project during the interviews. Five of the nine participants chose to discuss projects that helped others indicating the importance of projects that serve a purpose or are targeted toward the benefit a particular group rather than projects for self-development or self-fulfillment alone.

Self-Expression. Coming from the Focus on Oneself factor, the second theme for the AD Group was Self-Expression (3.01) which addresses self-recognition of special talents and abilities, expressing emotions and opinions, and developing traits relative to individual uniqueness (Casakin & Kreitler, 2010). This was also the second theme for ID (2.96). Differing from the AD and ID groups, the CD group's second theme was Non-functionality (3.05) which is a Focus on the External World factor and encompasses a willingness to begin projects even if the end result isn't clear. This would indicate that AD and ID groups value self-expression and sharing of opinions over the ability to work in unclear or partially

planned situations. This difference could be due to differences in applied content settings. AD and ID students could be receiving clear instructions and timelines for their design projects while CD students may be beginning work on costumes for productions whose designs and casting are not yet complete.

The interviewees addressed self-development and self-recognition of their talents as they gained more skills and abilities within the apparel technology course and willingly shared both successes and failures during the interviews. The interview theme of *Perseverance and Personal Growth* captures the self-development process. They shared situations where they encountered design problems that required substantial effort to solve and described a great sense of accomplishment and personal growth that occurred as they successfully solved the problem. Often the problem solving was described as incorporating multiple failures and their perseverance and determination carried them to finding a solution. Apparel design technology students seemed open to challenges as a growth opportunity and are willing to invest substantial effort into solving design problems if they find value in the project such as products that benefit others or support initiatives as addressed in the previous theme.

The *New Opportunities and the Future* theme encompassed willingness to learn about apparel technologies was contextualized by their understanding of the future of technology relative to apparel. They desired to maintain current professional skills in preparation for future employment.

Freedom in Acting. Freedom in Acting (2.88) was the third theme for the AD group. This theme is part of the Focus on the External World factor and addresses working within a specific knowledge domain but having freedom to think and act without following rules set

by others (Casakin & Kreitler, 2010). The ID and CD groups differed from the AD group. The ID group's third theme was Self-Development (2.85) from the Focus on Oneself factor and addresses developing oneself by investing, promoting, and guarding oneself. The CD group's third theme was Inner World Emphasis (3.00), part of the Focus on Oneself factor, and encompasses knowing oneself and expressing thoughts, feelings, and imaginations. It would appear that AD participants value self-directed settings within a knowledge domain more than ID and CD participants.

The value of self-driven projects or settings was echoed in the interviews. Participants described motivation as *passion* or *drive* that compelled themselves to continuously think, plan, and work on their projects. This internal motivator compelled them to make their own decisions on their projects in terms of materials, approach, and scope. Feelings of passion or drive were often coupled with excitement and happiness. Of all the interview themes, the theme of *Passion and Drive* one received the most specific comments from each participant.

The presence of the Freedom in Acting theme in the top three scored coupled with interviewee's descriptions of drive and passion suggests that apparel design technology students would do well in self-directed study situations or on individual projects that do not require regular oversight. Many final projects in apparel design coursework are individual in nature, so it is not unexpected to see the Freedom in Acting theme among the top three theme scores. This supports findings by Seemiller and Grace (2016) who found that Gen Z students are motivated by their own passions to pursue their interests independently and progress in the development of their individual efforts

Self Beliefs. Containing both internal and external factors, the highest scoring belief construct for all groups was Self Beliefs. This belief construct contains aspects of self-development, self-acknowledgement of individual skills and abilities, helping others, and the continued development of talents in pursuit of new achievements in new domains. All the statements on the COQ-CR within this belief type use “I” as the subject, so heavy meaning is placed on the individual’s own growth and development. Some statements indicate perseverance related to finding solutions or attaining levels of excellence. Although there is great emphasis on individual development, there is also recognition of the environment and that content drawn from the environment supports the individual and their goals. One of the statements within this belief is “I am prepared to invest a lot in order to do something that will help a lot of people”. This statement is also part of the Contribution to Society theme which was the highest scoring theme and is indicative of the Gen Z learner.

It is not surprising that all groups scored this belief the highest as Self Beliefs contain many elements that align with Gen Z’s values. Gen Z recognizes the importance of the individual in all forms and the development of an individual’s unique talents (O’Boyle et al., 2017). Determination and responsibility to complete actions are hallmarks of the Gen Z learner (Seemiller & Grace, 2016) and these innate traits could be used for self-development or solution finding. With an almost a hyper-awareness of the environment, members of Gen Z use their digital connectedness to pull information from the world to drive their social actions, finding information and truths, and making consumer decisions (Blumenfeld, 2019; Gomez et al., n.d.).

All groups scored the beliefs in the same order: self, goal, general, and norm. According to CO theory, this would indicate a similar cognitive orientation of the groups.

The participants in this study are likely to approach and complete a task similarly using similar thinking and meaning making (Kreitler, 2013). This suggests that all groups value self-development opportunities of many types and might be more committed to design projects where individual growth is evident.

Self-development and the continual development of talents involve the acquisition of new skills and knowledge. Interviewees discussed interest and curiosity as driving forces for development of their own knowledge and abilities. Several interviewees indicated they personally wanted to learn how to integrate technology into apparel. The role of interest and curiosity is consistent with participants being emerging adult learners in a period of experimentation and exploration (Arnett, 2000). It is not surprising to see comments from the interviewees related to curiosity and discovery as they develop self-sufficiency behaviors. Participant curiosity seemed to be driven by being aware of the technologies but not knowing how to implement them. One interviewee described her hesitation in enrolling in the apparel technology course due to lack of knowledge about any of the technologies. However, the desire to know about these new technologies overrode any concern of failure that would have prevented her from enrolling in the course. Reflecting on their own abilities, they saw the apparel technology course as a new opportunity to pursue self-development and the attainment of an employment-ready professional skill set. Keenly aware of the future of apparel creation processes, students expressed excitement about learning about technologies at the beginning instead of catching up later. The newness and unknown of the technology-based methods was appealing to several of the students.

Determination in not only solving design problems but in a high-quality manner was discussed by several students. These comments relate directly to the Self Belief statements

that address attaining levels of excellence. Most apparel design technology students were not satisfied by a proof-of-concept prototype and would have willingly continued to evolve their projects through more prototype iterations in pursuit of higher quality work. Using aspects of the external environment to support their goals, apparel technology students valued both positive and critical feedback and viewed both as idea validation. Several students described people's positive reactions to their apparel technology projects with one student sharing that people wanted to purchase her project. This external validation was important to the apparel technology students and suggests that this type of validation indicates that their project has meaning beyond the student's personal, internal goals. Group memberships provided opportunities for collaboration and encouragement. Support by others in the group or team was viewed as contributor for increased or consistent self-motivation.

The COQ-CR constructs that contributed most to motivations for creativity to the AD group were Contribution to Society, Self-Expression, Freedom in Acting, and Self Beliefs. The constructs were supported by interview responses from students enrolled in an apparel design technology course. Further, many of these constructs are also innate characteristics of the Gen Z generation of which most students in this study are members. While these constructs are important elements when considering apparel design student's motivations for creativity, establishing the association between motivation constructs and creative output would assist educators in leveraging these motivation characteristics in the development of design project assignments.

Association of Motivations for Creativity and Creativity Scores

To determine associations between COQ-CR construct scores and creative output, constructs scores for the Correlation Group were correlated with creativity scores obtained

through the Consensual Assessment Technique (CAT). Following recommended CAT methods as presented in the Methods chapter, five judges evaluated participants' projects for creativity using a 5-point ordinal scale (1= low to 5= high evidence of creativity). A mean creativity score for each Correlation Group member was calculated from judges scores. Three relatively strong correlations with large effect sizes were found when COQ-CR scores for factors, themes, and beliefs were correlated with the creativity score. Effect size or coefficient of determination is "the percentage of variance in the dependent variable that can be predicted from the independent variable" (Leech et al., 2015) or "the proportion of variation in one variable that is accounted for by the variation in the other variable" (Aggarwal & Ranganathan, 2016). The three relatively strong correlations were found among the themes and not in the factors or beliefs. These themes are different than the themes that contributed most to the overall motivations for creativity scores on the COQ-CR for the AD and Correlation Groups.

Non-Functionality

The theme of Non-Functionality (.51) was relatively strongly positively correlated with creativity scores with a large effect size indicating that 25% of the variance in creativity scores can be accounted for by the variance in the Non-Functionality score. As the sixth highest scoring theme for the AD Group, Non-Functionality addresses being ready to act if there is no "immediate benefit", accepting that "not every idea can be implemented in practice", or beginning work "even if the final application is not apparent at the beginning of the project" and (Casakin & Kreitler, 2010). Non-functionality scored sixth of the eleven themes and although it is not one of the highly contributing constructs, it contains statements that relate to developing ideas and experimentation which appear to be needed skills for

apparel industry employees who must adapt quickly to changes in processes (Cole, 2020). In addition, the large effect size of Non-Functionality to Creativity could help educators identify students who may be naturally inclined to work in under-defined settings and still produce a highly creative product. These students could be better placed in internship or undergraduate research opportunities.

Inner World Emphasis

Inner World Emphasis (.50) was also relatively strongly positively correlated with the Creativity score. The large effect size would indicate that 25% of the variance in creativity scores can be accounted for by the variance in the Inner World score. Inner World Emphasis was the seventh theme for the AD Group and addresses identification and development of an individual's thoughts, feelings and ideas and the ability to share ideas without harm (Casakin & Kreitler, 2010). This theme was part of a block of three themes that had a score differential of .01. This small difference is not meaningful and indicates that the AD Group did not prioritize any of the three themes over the other. However, Inner World Emphasis was the only theme of the block of three to have a relatively strong correlation with the creativity scores and a large effect size. Inner World Emphasis could be tied to self-confidence in sharing ideas or presenting design concepts at early stages. High scores on this construct could identify students with strong presentation skills (a necessary skill in design work) or low scores could identify students who need intervention and support in this area. This score could be expected to increase as the Emerging Adult Learner moves through the college experience and gains confidence in their knowledge and abilities (Arnett, 2000) and therefore would also improve their creative output.

Restricted Openness

The negative correlation of Restricted Openness (-.56) with creativity scores indicates that as the Restricted Openness scores increase that the creativity score would decrease. Thirty percent of the variance in creativity scores could be accounted for from the changes in scores on this theme. A Focus on the External World factor, Restricted Openness encompasses absorbing information from the environment but resisting being overwhelmed by the external stimuli (Casakin & Kreitler, 2010). This theme ranked tenth out of eleven themes for the AD Group. Through interviews, participants described their relationship with external motivators as a positive one and they drew validation, collaboration, and parallel learning experiences from outside of themselves that supported their work. There was no mention of external factors from a negative perspective. This is not a surprising relationship between environmental factors and creativity given that the AD Group prioritizes contributing to society above all other themes.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to investigate and describe apparel design student perceptions of motivations for creativity within an apparel design technology context. This investigation contributes to the existing literature in design education and to the emerging area of apparel design education relative to design technologies that meet the employee knowledge needs indicated by industry stakeholders (Chico's Education Round Table, 2017; Cove, 2016; Nike Education Round Table, 2017). The findings from this study will contribute to a better understanding of apparel design student motivations for creativity factors, their perceptions of motivations for creativity within an apparel design technology context, and to discern a relationship between motivational constructs and creative outputs. A broad research question was developed to address the overarching goal of this study:

What are apparel design student perceptions of motivations for creativity within an apparel technology context and do these perceptions have an association with creative output?

The research question was focused into three related sub-questions:

- Sub-question 1: What constructs contribute most to perceptions of motivations for creativity for apparel design students and how do these constructs differ from students in related design disciplines?
- Sub-question 2: How do apparel design students perceive external and internal motivation factors for creativity in the context of an apparel technology course?
- Sub-question 3: What is the association of motivations for creativity constructs and apparel technology project creativity scores?

Representing three distinct but related knowledge domain groups, students in apparel design (AD), interior design (ID), and costume design (CD), completed the Cognitive Orientation Questionnaire for Creativity (COQ-CR). Construct scores were calculated for factors, themes, and beliefs. Construct scores for the AD group were analyzed to determine which constructs contributed most to overall perceptions of motivations for creativity, and these constructs were compared and contrasted with the ID and CD groups. An Interview Group that was a subgroup of the AD Group provided qualitative data to explain the findings of the COQ-CR. Interviews were coded into themes and themes were grouped into categories. A subset of the AD Group, the Correlation Group's final apparel technology project received a creativity score from a panel of expert raters. The creativity score was correlated with the Correlation Group's construct scores from the COQ-CR to determine any relationships between constructs and creativity scores.

Major Findings

Analysis of participants' responses to the COQ-CR indicate that apparel design (AD) students are motivated for creativity through a balance of external and internal constructs. Similarly, interview responses indicated a balance of external and internal motivations towards creative activities. Interview responses were coded into eight themes, and the themes were grouped into two categories of external and internal. The external interview category contained themes of positive feedback and constructive criticism from others, the creation of products with a purpose, and the benefits of group membership and collaboration. The internal interview category focused on themes of internal drivers, personal interest, pursuit of quality, personal growth, and the potential to learn

professionally relevant skills. Classic extrinsic motivators such as rewards were not found to be a motivating factor.

When reviewing the highest scoring constructs on the COQ-CR, four constructs were found to contribute more than others to perceptions of motivations for creativity: two external themes--Contribution to Society and Freedom in Acting; one internal theme—Self Expression; and one belief-- Self Beliefs. These themes and the belief from the COQ-CR are presented and supported and explained by interview data.

The top three COQ-CR themes for the AD Group contain both external and internal themes which is expected by the balanced scores on the two factors presented at the beginning of this section. Factors are composed of themes, so it is expected to see both external and internal themes represented. The highest scoring theme of Contribution to Society provides an indication that apparel design students value meaningful contributions to society and helping or influencing others without personal gain. It is not surprising to see this construct as the highest scoring due to Gen Z's social and ethical values within a society (Fontelera, 2020). Interview analysis indicated the apparel design technology students had great interest in creating products that helped others in some way. The Self-Expression theme had the second highest score and revealed participants' desire to realize individual talents, express themselves freely, and to develop their own skills and abilities. Self-recognition and self-development of skills were important to interviewees who described challenges in the design process that resulted in solutions that led to a sense of accomplishment and personal growth. The third theme of Freedom in Acting acknowledges the knowledge domain provided through the external environment while allowing the participant to think freely and to develop work while following self-selected rules and

projects. Passion and drive were described by all interviewees as the motivational force that kept them working and solving problems. This internal motivator propelled the student through the design process as they made choices that eventually led to a successful project.

The highest scoring COQ-CR belief was Self Beliefs for the AD group. This belief contains statements addressing both internal and external motivators for creativity and focuses on self-development, acknowledgement of individual skills and abilities, and the continued development of talents in pursuit of new achievements in new domains. Emphasis is placed on development of the individual but recognizes the importance of the external environment as a place from where to draw knowledge in support of individual goals.

Apparel design students are similar to interior design and costume design students in that they all value making meaningful contributions to society. AD and ID groups acknowledge the need for self-recognition of special talents and abilities and developing these traits relative to individual uniqueness while the CD group places a slightly lower priority on this construct. Self-directed settings within a knowledge domain are valued by AD participants more than ID and CD participants. The differences between the groups do not appear to be great enough to impact course pedagogy where courses are shared across apparel, interior, and costume design students. All groups scored the beliefs in the same order: self, goal, general, and norm and would indicate a similar cognitive orientation of the groups. The participants in this study are likely to approach and complete a task similarly using similar thinking and meaning making (Kreitler, 2013). This suggests that all groups value self-development opportunities of many types and might be more committed to design projects where individual growth is evident.

Positive relatively strong correlations were found between themes of Non-Functionality and Inner World Emphasis with creative outputs with effect sizes that could account for 25% of variability in creativity scores. This would indicate that AD students are open to working on projects that are more conceptual or do not have apparent application. The positive relatively strong correlation indicated that improvement or development of skills in this area could contribute to more creative project outputs. Inner World Emphasis contains aspects of learning about oneself and development of an individual's thoughts, feelings and ideas and the ability to share ideas without harm. Development in this area could lead to improved creativity output through more confidence in design ideas and more open to sharing or discussing those ideas. This is an area of development for the emerging adult learner as well. It is expected that areas of self-awareness and self-confidence will be changes as the emerging adult transitions into the young adult.

A negative, relatively strong correlation was found between the theme of Restricted Openness and creativity scores with an effect size that could account for 31% of the variability in creativity scores. An external theme, Restricted Openness addresses absorbing information from the environment but resisting being overwhelmed by the external stimuli. The negative correlation would indicate that as students become more comfortable drawing from the external world creativity may decrease. Interviewees described their relationship with external motivators as a positive one and they drew validation, collaboration, and parallel learning experiences from outside of themselves that supported their work. This theme ranked tenth out of eleven themes for the AD Group and while there is a relatively strong correlation and large effect size, Restricted Openness does not contribute greatly to the COQ-CR themes on which the AD Group scored highly.

Contribution to the Literature

A gap of knowledge was identified from the review of literature in apparel design education research. Both Faerm (2015) and Norman (2010) have cited design education's lack of evolution, but Chakrabarti (2010) specifically identified the need to better understand design students' motivations, the relationships between motivations, and how these motivations impact creativity. This study has contributed to the existing body of apparel design research by identifying constructs that contribute to motivations for creativity scores and offered explanations by apparel design technology students of why these constructs matter to them as learners. Constructs with relatively strong relationships to creativity were identified. More research is needed regarding motivational factors that are meaningful to apparel design students and not continue to use and reuse motivational incentives that have worked with preceding generations of students. The Gen Z generation that is present in undergraduate education settings at the time of this study has different values than the previous generation of Millennials (Fontelera, 2020; Gomez et al., n.d.; Seemiller & Clayton, 2019). The results of this study contribute to the gap in the research literature and set the foundation for a larger body of research relative to apparel design student motivational factors, pedagogical practices, and the greater apparel design student experience.

Educational Opportunities

With participants placing equal value on external and internal factors described in this study, it would be advantageous for educators to include both of these attributes when designing projects to leverage apparel design students' innate motivational tendencies. While self-selected projects allow the student to have autonomy and self-development and self-expression opportunities, these projects could allow a student to avoid external

influences entirely. This could be problematic among younger students who are still at the early Emerging Adult developmental stages and developing self-confidence. A well-designed project that includes elements from students' internal and external factors would allow for the greatest opportunity for high motivation for creativity to be applied to the work.

Contribution to society was the top theme for the apparel design group and is an inherent trait of the Gen Z generation. Results from the COQ-CR indicate that AD students would be motivated to work more creatively on projects oriented toward benefitting others. It would be advantageous for educators to include client or public facing projects benefitting the end user that would leverage this built-in motivational trait.

The high score on the COQ-CR theme of Self-Expression indicates a willingness to invest and improve oneself. This could be a trait that would lead to continual or life-long learning which is a desired trait for employees in the apparel industry (Cole, 2020). The apparel industry is constantly evolving as new technologies are developed. As a result of COVID-19 lockdown adaptations, apparel companies have had to become more creative in their work processes to keep businesses open. Many industry reports indicate that some processes adopted during the lockdown are here to stay and changing industry processes permanently (REWIND, 2020). Companies that were able to pivot quickly were able to survive the pandemic. Others were not so fortunate. It is likely that companies may deliberately seek employees that are adaptable, and willing to learn new ways of working to future-proof their companies against events that dramatically change business practice.

The relatively strong positive correlations and large effect sizes between creativity and Non-Functionality and Inner World Emphasis themes could provide an opportunity for

development of traits associated with these themes that could lead to improved creativity on design projects. Non-Functionality addresses the willingness to act even if the final application of the project is not apparent at the beginning. Inner World Emphasis describes the identification and development of an individual's thoughts, feelings, and ideas and the ability to share ideas without harm. The large effect sizes indicate that 25% of the variability of scores on Non-Functionality and Inner World Emphasis could predict variance on creativity scores. With the positive correlation between the themes and creativity, a positive increase in a skill or ability associated with a theme could lead to a positive increase in a creativity score.

The emerging adult is in a period of experimentation and exploration as they find and develop qualities to become self-sufficient (Arnett, 2000). This state of exploration was described as curiosity by interviewees, and they described how their curiosity and interest of the unknown compelled them to learn more. Traits of exploration and curiosity would indicate that apparel design technology students are open to learning new content that is different than traditional methods. Educators should leverage this innate tendency for exploration and experimentation as emerging adulthood is a time of openness to trying new things

By leveraging innate constructs that are already part of the apparel design student motivational make-up, design project output may be more creative with less coaching from the instructor or less frustration about how to motivate a student to do something. Careful selection of project types and goals that relate to these motivational factors that are already valued by the apparel design student could support better project engagement in pursuit of a creative outcome.

Limitations

External generalizability (external validity) of the study is limited due to the use of a non-random sampling method that used a purposeful sample of design students from public universities. No existing studies could be found using the COQ-CR with these populations. However, using the proximal similarity model, results may be generalized to populations that are similar in size and characteristics which may reduce some of the threats to external validity (Trochim, Donnelly, & Arora, 2016, pp. 34–35).

A case study by definition is narrow in scope and focused (Savin-Baden & Howell Major, 2013, p. 154), and the small sample of nine AD students enrolled in an apparel technology course was appropriate for a case study. While the case study method describes the experience of participants involved in this research project, the results may not be considered to be generalizable in the broader research context. Flyvbjerg (2006) argues that case-study research within the social sciences is a useful and valid method that can provide context-dependent knowledge which is more typical of human settings. The strong, specific example found through a case study can uncover key information that a broad or general study cannot (Flyvbjerg, 2006). While among some research communities, case studies may be perceived as limiting and non-generalizable, in this case, with a developing educational content area of apparel technology, it could be appropriate to make some generalizations to other apparel design technology students until there are more studies available or the population increases.

It is possible that the COQ-CR is not an appropriate tool to measure motivations for creativity among apparel design students. The close scores of themes made it challenging to determine if there were clear constructs impacting motivations for creativity. The close

scores could mean that the instrument is not able to detect differences within these groups or that there are no differences.

Interrater reliability was not obtained on the CAT. Previous literature regarding the CAT indicates that this is part of using the technique. There were some deviations from CAT procedure. While participants who were being evaluated all completed a project using the same brief, participants were allowed to choose product type, material, and target consumer which resulted in many different projects. CAT protocols suggest using the same project and same materials. The choice was made to deviate from the protocol and implement the CAT in a more real-world setting where designers are not all producing a product with identical materials. The CAT evaluation was also done through Qualtrics using student supplied images and descriptions. The quality of both varied and this could have impacted the expert evaluation in a variety of ways.

Recommendations for Future Studies

A well-researched understanding of motivational constructs for creativity among apparel design students could form a starting point for research into best apparel design pedagogy practices and further research into motivation for creative outputs. This knowledge would allow educators to better support the emerging apparel designer and leverage innate traits in this group for success. For example, the desire to develop their individual skills may be challenging to leverage in a classroom where students are expected to complete the same assignment, but in a studio setting where design students typically pursue individual projects it may not be. More research is needed to determine if this trait is typical among apparel design students and whether or not the lack of this trait is detrimental to students considering an apparel design program of study.

The results of this study set the stage for larger-scale investigations such as regional or national distributions of the COQ-CR to build a more accurate understanding of motivational constructs for creativity among apparel design students studying in the United States at 4-year institutions. Apparel and fashion design programs also exist at 2-year institutions and those students may produce different COQ-CR results. With the rapid adoption of digital patternmaking and virtual prototype during the COVID-19 pandemic, companies are looking for employees with skills to support these technologies. Digital patternmaking and virtual prototyping were not among the technologies used in this study. Based upon the industry demand for these skills, research on motivation for creativity using digital patternmaking and fitting systems among apparel design students would be a logical next study.

Since the COQ-CR has never been used with apparel design students before, there is no data to determine if motivations for creativity change over time. The emerging adult learner is going through tremendous change as they are developing into an adult, and these developmental changes could impact perceptions of motivations for creativity constructs. Conversely, there could be some constructs that remain the same due to knowledge domain or other factors. Longitudinal studies where the COQ-CR is completed each year by apparel design students while in an undergraduate setting may be beneficial to determine how motivations for creativity constructs evolve as the emerging adult learner continues to develop.

It is not clear if the COQ-CR is the most accurate measurement tool of motivation for creativity for apparel design students. CO theory provides a method for developing other CO questionnaires for specific knowledge domains. Questionnaires have been developed for

mathematics and for clinical psychology. It is possible that the development and deployment of a CO questionnaire for apparel design thinking might produce factors, themes, and beliefs that have greater score differentiation between constructs, and therefore provide strong evidence of motivational constructs.

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Appendix A
COQ-CR Questionnaire

Beliefs About Self

The following statements describe different personality tendencies, feelings, attitudes and behaviors of people.

1. I try to invest in myself and to develop myself
2. I am not satisfied with any achievement and always strive for new achievements in new domains
3. I mostly see things differently than other people
4. I try to highlight within myself those aspects that are unique and in which I differ from others
5. It is important for me that my ideas should be not only good but also feasible
6. I love games
7. I like imagining to myself how various things happen
8. I am more interested in what happens outside, in the world, or to others, than in what happens inside me
9. Overall, most of the things that have happened to me were because of what I wanted and did and not because of the conditions, luck or fate
10. I am prepared to invest a lot in order to do something that will help a lot of people
11. I feel the need to express myself, my thoughts, and my inner world
12. I don't mind doing things without knowing ahead of time how they will turn out

13. When I work on something that I care about, I demand from myself to attain the level of excellence that I have determined for myself and I am not ready to be satisfied with less
14. I try to absorb from the environment and from others only that which is adequate for me and my goals

General Beliefs (how things are)

The following statements describe people, situations and events in reality in general.

1. An individual with special talents and abilities feels more than others that he/she has to take care of himself/herself
2. Whoever is not satisfied with what he/she has achieved and strives for new achievement, eventually fails
3. If while doing something one is exposed to difficulties and failures it makes no sense to persevere and continue doing it because also later there will be only difficulties and failures
4. If a person expresses all one's thoughts and feelings it may harm him and his environment
5. An individual who has special talents and abilities feels that he has to do everything in order to develop these talents
6. One cannot attain any achievement without acting in the framework of clear rules that define the situation and the targets
7. A single person can hardly change anything in others

8. One can develop much more if one learns about the world and others than about oneself
9. If a person did not attain the level of excellence to which he strove, this is actually a failure
10. Things without any ambiguity are uninteresting
11. Something may be considered as success if a person attained what he wanted and it is quite unimportant what others think about it
12. Games are appropriate mainly for children
13. An idea that cannot be applied has no value
14. If a person exposes oneself to many stimuli and materials from the environment, it may hurt one's creativity and originality
15. If one does not highlight within oneself the unique features, then one becomes similar to all others
16. One can learn something from each contact with the environment
17. To understand something means to grasp it as others have shaped it and interpreted it

Norm Beliefs (how things should be)

The following statements refer to how things should be, to the desirable.

1. It is not necessary to express outwardly too much of your inner world
2. It is necessary to do things even if one is not absolutely sure ahead of time that it will turn out right
3. Even if a person has special abilities, there is no justification for him to realize them
4. One should be ready to invest a lot in order to do things that will help many others

5. One should be ready to compromise concerning the level of excellence one demands from oneself
6. One should know how to accept limitations – in regard to the freedom to think and the freedom to do what one wants
7. One should absorb from one's environment only those things that are relevant for hi/her and could be helpful
8. It is necessary always to strive to turn one's ideas into something operable which can be applied
9. One should try to see things as others do
10. One should be interested primarily in that which happens within oneself
11. One should avoid efforts targeting one's own development
12. One should highlight within oneself those things that are shared by him/her and others
13. One should be satisfied with one's achievements and not strive always for new achievement
14. One should not think that anything in life depends on oneself because everything is a function of circumstances and fate
15. One should do things so that others can consider him as successful

Goal Beliefs

The following phrases refer to goals and wishes.

1. To see things in my own way, differently from others
2. To play less

3. To take care of myself because of the special talents that I have
4. In everything that I do to influence others, to change something in them
5. To function always in the framework of clear rules that define the situation and the targets
6. In whatever I do to attain the level of excellence that I have demanded from myself
7. To deal only with themes or domains that have applications
8. To deal with problems or situations that are not completely clear
9. To acquire from others and from the environment only that which is adequate for me and may help me
10. To get to the point when my deeds are considered by others as success
11. To be interested more in what happens outside than in what happens inside me
12. To be able to realize the abilities I have and to do with them something
13. To invest in myself so that I could develop

Appendix B

Interview Questions

1. Describe motivation?

2. How do you know if you have it?

a. Probe: Is it from within? Is it external like a reward?

3. Why are you motivated (or interested? or curious?) to learn about design technologies?

4. Think about one of the design projects/problems in the course. What did you do to solve it?

a. Probe: Why did you choose this approach? What was the quality of the output?

Appendix C

University of Idaho

Office of Research Assurances

Institutional Review Board

875 Perimeter Drive, MS 3010

Moscow ID 83844-3010

Phone: 208-885-6162

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irb@uidaho.edu

To: Allen Kitchel
Cc: Lori Ann Wahl
From: Jennifer Walker, IRB Coordinator

Approval Date: September 12, 2017

Title: Motivating Creatives: Undergraduate Education in Apparel Design Technology

Project: 17-178

Certified: Certified as exempt under category 1,2 at 45 CFR 46.101(b)(1,2).

On behalf of the Institutional Review Board at the University of Idaho, I am pleased to inform you that the protocol for the research project Motivating Creatives: Undergraduate Education in Apparel Design Technology has been certified as exempt under the category and reference number listed above.

This certification is valid only for the study protocol as it was submitted. Studies certified as Exempt are not subject to continuing review and this certification does not expire. However, if changes are made to the study protocol, you must submit the changes through [VERAS](#) for review before implementing the changes. Amendments may include but are not limited to, changes in study population, study personnel, study instruments, consent documents, recruitment materials, sites of research, etc. If you have any additional questions, please contact me through the VERAS messaging system by clicking the 'Reply' button.

As Principal Investigator, you are responsible for ensuring compliance with all applicable FERPA regulations, University of Idaho policies, state and federal regulations. Every effort should be made to ensure that the project is conducted in a manner consistent with the three fundamental principles identified in the Belmont Report: respect for persons; beneficence; and justice. The Principal Investigator is responsible for ensuring that all study personnel have completed the online human subjects training requirement.

You are required to timely notify the IRB if any unanticipated or adverse events occur during the study, if you experience and increased risk to the participants, or if you have participants withdraw or register complaints about the study.

Appendix D

INFORMED CONSENT

for Interviews for a Research Study entitled

Motivating Creatives: Undergraduate Education in Apparel Design Technology

You are invited to participate in a research study to share your perspectives on your educational experience at the University of Idaho. This study is being conducted under the direction of Dr. Allen Kitchel by Lori Wahl within the College of Education at the University of Idaho. You were selected as a possible participant because you are enrolled as a major in: Apparel, Textiles and Design, Interior Design, Virtual Technology and Design, or Theater Costume Design in the Fall 2017 semester.

What will be involved if you participate? If you decide to participate in this research study, you will be asked to complete a survey through Qualtrics. Your total time commitment will be approximately 15 minutes.

Are there any risks or discomforts? There are no perceived risks associated with participating in this study. We will collect your name only. To minimize risks, all information will be maintained confidentially in a locked office. You will be assigned a pseudonym, and your responses will not have any identifying information when used for publication.

Are there any benefits to yourself or others? Although there are no personal benefits, you can expect to make a general contribution to the effort to help understand how students in design disciplines perceive themselves and their efforts during their program studies.

Will you receive compensation for participating? There is no compensation for participating.

If you change your mind about participating, you can withdraw at any time during the study. Your participation is completely voluntary. If you choose to withdraw, your data can be withdrawn as long as it is identifiable. Your decision about whether or not to participate or to stop participating will not jeopardize your future relationship with the University of Idaho.

Your privacy will be protected. Any information obtained in connection with this study will remain confidential. Information obtained through your participation may be used for the purposes of doctoral study, possible publications, and presentations.

If you have questions about this study, please contact Lori Wahl by phone at 208-885-6302 or by lwahl@uidaho.edu. A copy of this document will be given to you to keep.

If you have questions about your rights as a research participant, you may contact the University of Idaho's Office of Human Subjects Research or the Institutional Review Board by phone 208-885-6162 or e-mail at .

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER
OR NOT YOU WISH TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR
SIGNATURE INDICATES YOUR WILLINGNESS TO PARTICIPATE.

Participant's signature Date

Investigator obtaining consent Date

Printed Name

Printed Name

Appendix E

INFORMED CONSENT

for Interviews for a Research Study entitled

Motivating Creatives: Undergraduate Education in Apparel Design Technology

You are invited to participate in a research study to share your perspectives on your educational experience in Apparel, Textiles and Design (ATD) and in particular your experience during FCS404 ST:Apparel Technology. This study is being conducted under the direction of Dr. Allen Kitchel by Lori Wahl within the College of Education at the University of Idaho. You were selected as a possible participant because you have enrolled in FCS404 ST:Apparel Technology in either Fall 2017 or Spring 2018.

What will be involved if you participate? If you decide to participate in this research study, you will be asked to participate in digitally recorded interviews (audio) asking about your experiences as an ATD student and the projects completed in FCS404 ST:Apparel Technology. Your total time commitment will be approximately 40 minutes. Your Final Project from FCS404 ST:Apparel Technology will be evaluated by a panel of industry experts following the course. Your name and identifying information will be removed, and your project will be assigned a number. You will be able to receive the panel's feedback on your project. Your participation in the interview and the panel's feedback have no impact on your final grade for the course.

Are there any risks or discomforts? There are no perceived risks associated with participating in this study. We will collect your name only. To minimize risks, all information will be maintained confidentially in a locked office. Digital recordings from the interview will be destroyed after transcription. You will be assigned a pseudonym, and your responses will not have any identifying information when used for publication.

Are there any benefits to yourself or others? Although there are no personal benefits, you can expect to make a general contribution to the effort to help understand how ATD students perceive themselves and their efforts during their program studies and during the FCS404 ST:Apparel Technology course.

Will you receive compensation for participating? There is no compensation for participating.

If you change your mind about participating, you can withdraw at any time during the study. Your participation is completely voluntary. If you choose to withdraw, your data can be withdrawn as long as it is identifiable. Your decision about whether or not to participate or to stop participating will not jeopardize your future relationship with the University of Idaho.

Your privacy will be protected. Any information obtained in connection with this study will remain confidential. Information obtained through your participation may be used for the purposes of doctoral study, possible publications, and presentations.

If you have questions about this study, please contact Lori Wahl by phone at 208-885-6302 or by lwahl@uidaho.edu. A copy of this document will be given to you to keep.

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HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO PARTICIPATE.

Participant's signature

Date

Investigator obtaining consent

Date

Printed Name

Printed Name