Defining Rigor in Family and Consumer Sciences

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Despite federal and state mandates that CTE programs, including FCS, offer rigorous curricula, there is currently no evidence of systematically defining rigor in the FCS discipline. Drawing from Biggs and Büchler (2007)*, who defined rigor for practice-based research in design, this paper argues that rigor originates from the practical-intellectual ecology and practice of the FCS discipline. Rigorous practice depends on the practitioner's critical studies surrounding the field, the ability to stir concern for the multidimensionality of issues, the exercise of intellectual dispositions, and the ability to promote praxis among students. Developing the practitioner's capacity for rigorous practice includes formation of a practical-intellectual community, promotion of practical reasoning skills, and acquisition of intellectual dispositions through pedagogical reasoning.*

Since its inception, the discipline of Family and Consumer Sciences (FCS) has been concerned with intellectually examining quality of life issues in an effort to determine how to best serve individuals, families, and communities. Brown and Paolucci (1978) outlined the breadth of study necessary to fully explore the intent of the discipline so that the field could promote in others the ability to advocate for themselves, contribute to the common good and consequently include more citizens in the practice of democracy. Brown and Paolucci sought to define the field, in an attempt to unify the focus and efforts of home economics (now FCS) professionals. Their scholarship serves as the basis for much of current FCS scholarship, especially the FCS Body of Knowledge (Nickols et al., 2009). Brown (1985) continued to hone the profession's understanding of itself, as she offered an examination of the aims, disciplinary content, call to service, and qualities of our shared "practical intellectual" community. For Brown, the notion of "practical" was related to that espoused by Greek philosopher, Aristotle, connoting "dialogue," as opposed to the more recent notion that has to do with technique, usefulness, or efficiency. Thus, for Brown, a practical intellectual community was one that fostered intellectual dialogue among FCS professionals in an effort to develop a unified purpose and subsequently, a practice centered on that unified purpose.

Using the work of Brown and Paolucci (1978) and Brown (1985) as a framework, many FCS scholars have continued to explore the discipline's intellectual purposes in relation to the notions of community and family well-being in relation to professional obligations to serving others (Baldwin, 1995; Brown, 1995; Henry, 1996; Miststifer, 1996; Pendergast, 1998; Smith, 1998). Likewise, FCS teacher education scholars have extended the work of Brown and Paolucci, by exploring critical science perspectives related to research (Hultgren & Coomer, 1989) and curriculum (Johnson & Fedje, 1999), as well as practical reasoning development (Thomas & Laster, 1998). Despite these multiple efforts to examine and define the intellectual nature of the FCS discipline, there has not yet been an effort to define rigor in FCS. This is especially important in light of the federal mandate that Career and Technical Education (CTE) programs, including FCS, increase *rigor* across all CTE curricula (Public law 109-270 §2(2); Missouri DESE, 2008). The purpose of this paper is to examine the notion of *rigor* as it applies to the FCS discipline and its implications for FCS teacher education.

A Case for Rigor in Family and Consumer Sciences

The Carl D. Perkins Career and Technical Education Improvement Act of 2006 (Perkins 2006) seeks to

> develop more fully the academic and career and technical skills of secondary education students and postsecondary education students who elect to enroll in career and technical education programs, by . . . promoting the development of services and activities that integrate *rigorous* and challenging academic and career and technical instruction, and that link secondary education and postsecondary education for participating career and technical education students (Public law 109-270 §2(2)).

Within this piece of legislation, Career and Technical Education (CTE) is expected to offer a "sequence of courses that provide individuals with coherent and *rigorous* content aligned with challenging academic standards" (Public law 109-270 §3(5-A-i)). According to the legislation, "coherent and *rigorous* content shall be determined by the State consistent with section 1111(b)(1)(D) of the Elementary and Secondary Education Act of 1965" (Public law 109-270 §8(e)).

Using Missouri as an example, the *Perkins [IV] Summary and Future Plans for Implementation* (2008) offers no clear definition of what *coherent and rigorous content* means but perpetuates the use of the phrase, as the state addresses the federal mandate to provide increased and documented academic and technical *rigor* in both secondary and postsecondary Missouri Career Education courses. According to the document, this will be accomplished by ensuring that Missouri CTE programs of study are comparable in coherence and rigor to other academic programs, demonstrated by coursework that is aligned with academic standards. Additionally, *coherent and rigorous* content is substantiated by the quality of core academic coursework taken by students. Finally, the Missouri statute outlines the need for professional development opportunities for both pre-service and in-service educators, administrators, and counselors that encourage the development of curricula that integrates *coherent and rigorous content* with academic standards.

For those familiar with the mandates of Perkins 2006, the language of these documents is familiar. As CTE teachers and teacher educators are called on to deliver rigorous content to secondary and post-secondary students, neither the federal nor the state documents (exemplified by Missouri) have clearly defined what *rigorous* content actually entails.

As states and local education agencies began implementation of the Carl D. Perkins Career and Technical Education Improvement Act of 2006, efforts were made to bring clarity to the notion of *rigor*. Speaking to the need to include more challenging content, Hoachlander (2007) implicitly defined rigor as problem solving, critical thinking, communications, and teamwork, achieved through authentic experiences with core subjects that were effectively combined with CTE content. Perhaps a more explicit example is Boggess' (2007) definition of *rigor* as the quality of thinking . . . reflective thought. He continues with academic rigor is learning in which students demonstrate an in-depth mastery of challenging concepts through thought, analysis, problem solving, evaluation or creativity. The irony with either of these attempts to bring meaning to *rigor* for CTE professionals is that neither author demonstrated a *rigorous*, systematic attempt to define the term. In fact, a review of the literature has found no effort on the part of CTE scholars to determine what *rigor* means for the discipline.

FCS education content at both secondary and post-secondary levels must reflect the federal and state mandates for rigor as outlined in the respective pieces of legislation. Like CTE, there exists no explicit definition or application of *rigor* in the field of FCS, though a recent account of the applicability of the new Bloom's Taxonomy to FCS suggested its importance when aligning content to assessments (Pickard, 2007). More broadly, various FCS scholars—including those noted previously—speak to the importance of studied, scholarly efforts to better comprehend the impact of contextual factors (among other influences) affecting quality of life issues, which subsequently inform both disciplinary content and practice (Mitstifer, 1998; Nickols, Ralston, Anderson, Browne, Schroeder, & Thomas, 2009). Drawing from the work of Biggs and Büchler (2007) who examined *rigor* in the field of design, a framework for defining rigor emerges, which when applied to foundational FCS scholarship, substantiates a plausible definition of rigor for the FCS discipline.

Biggs and Büchler: Backdrop to Rigor in FCS

Biggs and Büchler (2007) examined the notion of rigor to shed light on the presumed differentiation of traditional academic research from practice-based research (typical for scholars in design) within higher education in the United Kingdom. The authors presented a rationale that defends practice-based research as a subcategory of academic research by centering their argument on the criteria for what comprises research, and giving particular attention to the criterion of rigor. Their etymological study found that the roots of the term *rigor* can be found not so much in the Latin "regidus," but in the Old French "rigueur," that is understood as "harshness" or "severity" (2007, p. 65). According to Biggs and Büchler (2007), rigor might be aptly understood as an unyielding severity of process that leads to valid conclusions.

Paired with Biggs and Büchler (2007) understanding that research is the pursuit of new information or knowledge, (2007), rigor in research can be found in the investigation itself—the *process* rather than the finding. Exemplified through the review of literature, typical to traditional academic research, Biggs and Büchler (2007) argued that a *rigorous review* must refer to the *process* of the review, as opposed to the technical exercise of writing the document. For these authors, the rigor of the literature review indicates a methodical and complete examination of the literature. Extending this line of thinking to practice-based research, the authors consequently surmised that in practice-based research, rigor lies in the *process* of the research—in the method utilized to answer a particular question. But does that necessarily equate process with practice? The authors contended that

> a valid method provides a rigorous logical connection between the question and its answer, and it is that rigor that is more important in validating the outcome than the rigor of the competencies that are used to put the method into practice. . .the practitioner has to demonstrate . . .the validity of a particular method to deliver the research solution [answer to a question] (2007, p. 68).

For Biggs and Büchler, the concept of rigor can be understood "as a quality of argumentation that legitimizes an outcome. . .[which] requires that practice is the method. . .[and justifies] that a certain practice is necessary" (2007, pp. 68-69). The key to their argument rests in the determination of the appropriateness of the practice in offering a legitimate answer to the question at hand.

According to these scholars (Biggs and Büchler), validation of the research method or practice is context-specific and is guided by the disciplinary community. Recognizing the standard practice of peer review, Biggs and Büchler called attention to the authority granted the community to judge whether or not the method or practice is suitable for answering a particular question. Therefore, in practice-based research—just as in traditional academic research—the standards, authority and responsibility for evaluation that fall under the jurisdiction of the discipline contribute to the depth of rigor subsequently attributed to the practice.

Application of Biggs and Büchler to FCS

The applicability of Biggs and Büchler's (2007) work to FCS hinges on the notion of *practice* that is central to their own disciplinary understandings of practice-based research and also to the disciplinary understanding that FCS is a practice-based, practical-intellectual field. As FCS is expected to deliver a *rigorous* curriculum to secondary and post-secondary students, it is essential for the profession to clearly define what our disciplinary community believes to be a *rigorous* FCS curriculum. In this section, the application of Biggs and Büchler's (2007) work to FCS will be outlined by more fully exploring (1) the role of the FCS disciplinary community; (2) the substance of the FCS practitioner's practice; and (3) indications of rigor through FCS practice.

The Role of the FCS Disciplinary Community

With roots dating back 110 years to the formation of home economics beginning with the Lake Placid Conferences, the disciplinary field of FCS is a product of serious intellectual development, review, critique, and revision on the part of various FCS professionals, including secondary teachers, teacher educators, FCS administrators, extension agents, and content specialists in education, for-profit and not-for-profit industries. More recent intellectual work can be seen in the FCS Body of Knowledge (BOK) (Nickols, et al., 2009) as well as in the current national FCS education standards and competencies (National Association of State Administrators of Family and Consumer Sciences (NASAFACS), 2008-2018a). Within each of these bodies of work, expectations for both an integrated and synthesizing approach to the study of FCS are apparent. Combined, the BOK, FCS standards, and FCS competencies provide a holistic view of the FCS disciplinary purpose and its reflection in FCS curricula.

These current efforts that make explicit the knowledge pertinent to the discipline rest on previous scholarly efforts, including Brown and Paolucci (1978) and Brown (1985), but also the work of more current scholars (Eyre & Peterat, 1990; Fedje, 1999; Hultgren & Coomer, 1989; Thomas & Laster, 1998). Specifically noted by Henry (1996), the FCS discipline draws on a critical sciences perspective utilizing the modes of rationality including technical, interpretive, and emancipatory forms of knowledge first introduced by Jurgen Habermas in 1968. As such, FCS professionals are expected to communicate factual, objective information addressing human interaction and use of resources (technical), foster meaning making among individuals, families, and communities by promoting dialogue (interpretive), as well as identify and address inequalities among individuals and groups by developing the capacity of those with whom they work (emancipatory).

Brown's (1985) philosophical framework for critiquing the discipline argued for congruency among the purpose and aims, discipline, practice (service), and intellectual ecology of the discipline grounded equally upon all three modes of rationality: technical, interpretive, and emancipatory knowledge. For Brown, the FCS disciplinary intellectual ecology ought to be

socially constructed among FCS professionals, drawing on the human ability to examine, ponder, wonder, theorize, criticize, and imagine realities different from the present (1985, p. 10). It is the inferred professional dialogue, rather than the technical notion of "practice as doing," that ultimately shapes this ecology as "practical-intellectual." Consequently, it is this practical-intellectual ecology, drawing upon a critical sciences perspective central to the BOK, FCS education standards, and FCS competencies that guides professional practice and gives substance to and makes *rigorous* the disciplinary curricula for FCS secondary and post-secondary programs.

It is important to understand that FCS practice obliges professionals to not only serve individuals, families, and communities, but also to serve peers, through collaborative, collegial efforts (formal and less formal) that seek to strengthen, i.e., make *rigorous*, professional practice through peer critique. Current formal efforts to promote FCS program accreditation, FCS professional certification, and pre-professional certifications demonstrate the disciplinary interest to standardize professional practice. Likewise at the state levels, accreditation of both secondary and post-secondary FCS programs offers similar standardization. The bases for these formal examples of standardization of practice should rest upon demonstrated understandings and application of the critical sciences perspective exemplified in the BOK, FCS education standards, and FCS competencies. Beyond these formal examples, FCS professionals may additionally support and critique other programs through peer curriculum review as well as offering input through advisory boards. Such efforts are in addition to the process of peer review of scholarship that extends throughout the discipline. As noted by Nickols, et. al. (2009), it is important to the discipline to encourage scholarship that examines the BOK from a critical sciences perspective that will ultimately inform practice.

Because a critical sciences view of the FCS discipline seeks to foster emancipation through promotion of democratic ideals, professional practice, as captured in the mission of FCS education not only attends to meeting the technical needs of those served, but it also seeks to meet the interpretive and emancipatory needs of others, whereby FCS professionals will assist others in:

- Strengthening the well-being of individuals and families across the life span;
- Becoming responsible citizens and leaders in family, community, and work settings;
- Balancing personal, home, family, and work lives;
- Using critical and creative thinking skills to address problems in diverse family, community, and work environments; and
- Appreciating human worth and accepting responsibility for one's actions and success in family and work life (NASAFACS, 2008-18b, ¶ 5).

Mission-related statements such as these require that pre-professional and professional development fosters an ability to utilize critical sciences along with the FCS BOK, standards, and competencies to adequately address the interpretive and emancipative dimensions of the disciplinary mission, which have particular implications for the disciplinary content and perhaps more importantly, how it is communicated.

The Substance of the FCS Practitioner's Practice

By asserting that *rigor* is found in the process or practice of the practitioner, Biggs and Büchler (2007) clarify the crucial function attributed to the practice of practitioners to promoting

rigorous curricula. And like Biggs and Büchler, who situate rigor in practice as opposed to standards and competencies), because the FCS profession understands that "the [FCS] national standards apply to all students. . . [and that] different students will achieve understanding in different ways" (NASAFACS, 2008-18b, ¶5), FCS is readily positioned to focus on the substance of the practitioner's practice to ensure rigorous curricula that stem from the FCS standards and competencies.

Stemming from the critical sciences perspective, practitioners are obliged to present research-based content (reflecting technical knowledge), but must also examine this information and other FCS issues from multiple perspectives—giving voice to alternative viewpoints to facilitate mutual understandings among learners. By so doing, individuals might be empowered to advocate for themselves and their families. Commitment to educating students from both interpretive and emancipatory modes of knowledge demonstrates why rigor must be situated in practice (Eyre & Peterat, 1990; Topp, 1999). From Brown's perspective, to do less threatens individual autonomy and community wellbeing:

> When we confine our approach to those we serve to acting as technical experts on how to do this or that, we are upholding technical rationality as the mode of rationality [emphasis in original]. Unless we recognize that hermeneutic [interpretive] rationality and emancipative rationality are to promote reflective understanding and moral direction in the goals sought and critical awareness of existing social beliefs and practices of political-moral concern, we inhibit the development of autonomous persons. This reflects not only in the persons whom we serve directly but also in these same persons' practices in promoting or hindering the development of others (1985, p. 42).

A practitioner's ability to foster reflective understanding and critical awareness warrants a change in practice. Transmitting complex series of facts to students must be informed by concern for an integrative rather than fragmented approach to understanding quality of life issues and well-being: practice must be approached as an intellectual endeavor. This shift is necessary if the FCS discipline is to grow beyond the historic inclination to uphold the technical mode of rationality.

The ability of FCS practitioners to pursue practice as an intellectual endeavor requires a change in pedagogical thinking. Pedagogy, as defined by the Oxford English Dictionary (2011), relates only to the practice or art of teaching. Often understood as the practice of teaching children, the focus on children, while essential, ignores a practitioner's responsibility to the practice of teaching itself, and the necessity of the practitioner's intellect reflected through his or her practice. While Biggs and Büchler understand research as a pursuit of new information or knowledge (2007), it might also be reasoned that research—typically the domain of higher education—could be likened to the study of particular subjects within the secondary education environment. Thus, the substance of the FCS practitioner's practice develops from his or her comprehensive study surrounding the FCS content to be taught, bringing rigor to his or her practice.

Indications of Rigor in FCS Practice

While implicitly the Perkins 2006 legislation suggests that rigor in CTE content is achieved by integrating math, science, English, and social studies, the notion to insert core subjects *and stir*, is at once, both overly simplistic and intriguing. With the understanding that

rigor is achieved through practice, it becomes clear that by only inserting core subjects will not result in added rigor in FCS. The FCS practitioner's ability to facilitate study of quality of life issues pertaining to individuals, families, and communities through a humanistic lens is a good beginning. Additionally, the practitioner's ability to draw on his or her own studies of the issue will permit the *stirring* of different ideas. Referring back to the days of stitching and stirring, the FCS practitioner's ability to foster in students the capacity to *mix*, *collect*, *fold*, *connect*, or even *agitate* the group's thinking might be an appropriate use of these verbs for 21st century FCS curricula. In addition to the depth and breadth of the content—*what* is thought about—consideration must also be given to *how* the content is thought about when considering the rigor of the FCS discipline.

Costa and Liebmann (1997) make explicit the importance of considering *how* content is thought about. Calling attention to the importance of teaching process skills to students, the authors outline the relationship between process skills, larger operations encompassing multiple skills, which then become habituated over time, resulting in a series of dispositions adopted by the individual. While much attention is given to fostering in students dispositions for thinking, limited attention is given to fostering in teachers these same dispositions. How an FCS practitioner demonstrates to students persistence, empathy, metacognition, accuracy, understanding and application of historical perspective, creativity, collaborative thinking, risk taking, curiosity, questioning, and even a sense of humor through his or her own practice will likely transfer to student thinking (Costa & Liebmann, 1997). For FCS practitioners, it is important to note that many of the dispositions support a critical sciences perspective of the field. For example, developing a curriculum that fosters both interpretive and emancipatory modes of knowledge would rely on the ability of both practitioner and students to listen, question, think cooperatively, take risks, examine historical precedent, offer creative insights, exercise precision and accuracy in thinking, all in an effort to develop mutual understanding of an FCS issue to better address the common good of the community (Topp, 1999; Williams, 1999).

The notion of the common good is central to the critical sciences perspective in FCS. It is not enough for FCS practitioners to teach *about* the social injustices that exist—it is Brown's (1985; 1995) intent that FCS becomes a vehicle for social change through curricula that develops the capacity of individuals, families, and communities to determine what the common good is for themselves and to work toward that end. Taken as a whole then, rigorous practice of an FCS practitioner is dependent on his or her comprehensive, critical sciences-based, study surrounding the field, an ability to *stir* in students concern for the multidimensional nature of FCS issues, the exercise of dispositions to guide how the content is thought about, and an ability to instill the capacity to change the status quo. From a critical sciences perspective, FCS practitioners seek to move their students and themselves toward *praxis*—action grounded in reflection for the purpose of social transformation (Foster, 1986; Stevens, 2002). And it is this sort of collaboration among peers and fellow citizens—that captures Brown's essence of the FCS practical-intellectual ecology.

Implications for FCS Teacher Education

With the mandate by Perkins 2006 for "coherent and *rigorous*" curricula at secondary and post-secondary institutions, it is crucial for FCS teacher educators to ensure that initial certification programs prepare pre-service teachers capable of exercising rigor in their respective practices. This paper argues that rigor originates from the practice and practical-intellectual ecology of the FCS discipline, and further proposes that teacher educators ought to focus

specifically on (1) the formation of a practical-intellectual community; (2) the development of comprehensive, humanistic studies surrounding FCS; and (3) the advancement of practitioner intellectual dispositions, all in an effort to develop the capacity for rigorous practice. By so doing, not only will the FCS discipline be positioned to meet the Perkins 2006 mandate, but it will also more clearly situate itself among the other disciplines, demonstrating congruity among its aims and purposes, discipline, practice, and practical-intellectual ecology—thus addressing the shortcomings of the FCS discipline identified 25 years ago by Marjorie Brown (1985).

As noted in the FCS Body of Knowledge, fostering community vitality is an essential aspect of FCS practice (Nickols, et al., 2009). At the post-secondary level, demonstrating to students how to form community is important, if they are to understand the value of the discipline's practical-intellectual ecology. Inculcating within students the sense of unity and its rationale must be deliberate. From the perspectives of DeMerchant and Johnson (1995), the sustainability of the FCS profession depends upon the ability to foster community among colleagues and students—the next generation of professionals. Collaborative in nature, the practical-intellectual community needs to promote inclusion and provide a sense of intellectual safety, where risk-taking is both modeled and encouraged. Because a community thrives when its members share a common interest, concern, and activity (Brown, 1995), a *practical-intellectual* community is sustained by *rigorous* study of issues pertinent to its members. Such studies provoke discussion around concerns that are of importance to individuals typically marginalized through status quo practices, and serve to generate emancipative possibilities for change.

The notion of study, suggests, at a minimum, the acquisition of knowledge. In Family and Consumer Sciences, a service-oriented profession, the purpose of knowledge acquisition is to address what Brown and Paolucci (1978) referred to as *practical problems* that are best understood through contextual examination. And unlike theoretical problems that typically are addressed within a particular discipline, examination of practical problems is more likely to cross disciplines (Schulman, 2004b) necessitating the need for a concentrated, multidisciplinary investigation surrounding the issue(s). Beyond the multidisciplinary lenses, Brown and Paolucci (1978), argued that study in a practical-intellectual field, such as FCS, requires study across multiple theoretical frameworks as well, including empirical, phenomenological, semantic, and normative theories. This sort of intellectual preparation is foundational to the process of *practical reasoning* which Brown and Paolucci (1978) argued is essential to resolving practical problems. Based in the interpretive mode of rationality, practical reasoning can be differentiated from mere decision making (technical rationality), in that it requires the *social* construction of judgments based on morally defensible grounds (Brown & Paolucci, 1978, pp. 26-29). It is through the development of practical reasoning that FCS practitioners are prepared to explore emancipative dimensions of knowledge that substantiate *praxis* within the field.

The final consideration for developing the capacity for rigorous practice links FCS practical reasoning with the acquisition of intellectual dispositions, hinging on Schulman's notion of *pedagogical reasoning* (2004a, pp. 233-241). In particular, it is Schulman's conception of both comprehension and transformation—the initial two processes of pedagogical reasoning—that are most relevant to appropriating rigor to one's practice. Schulman's concept of comprehension recognizes the need to study widely and deeply, as practitioners must comprehend content both within and beyond the discipline and that they should be able to demonstrate their understandings in multiple ways (2004a). Like Brown and Paolucci (1978), Schulman (2004a) believed transformation rests on the expectation that the practitioner is able to

critically interpret content and develop relationships between it and the lived experiences of students analogically, metaphorically, and through various explanations and examples (2004a). It is only after such transformation of knowledge that the practitioner should consider which modes of communication are most suitable for respective audiences. The order that Schulman (2004a) attributes to pedagogical reasoning gives credence to the previously stated concern surrounding the term pedagogy, which is often misunderstood as having more to do with the *method of teaching children*, rather than focusing on the *intellectual nature of teaching itself*.

By suggesting that a practitioner is responsible for understanding content from multiple perspectives and must likewise develop relationships between the content and student experiences, pedagogical reasoning and the notion of transformation subsequently lead to the question of *how* the content is thought about. It is Schulman's (2004b) perspective that practitioners must engage with *professional learning principles* that reflect Costa and Liebmann's (1997) dispositions introduced previously. These principles address *how* the practitioner engages with the content and include reflection, collaboration, and activity (i.e. designing, debating, writing, investigating, dialoging, questioning, etc.). Key to the principles is the underlying belief that learning ought to be active rather than passive and experienced within a *community of learners* (Schulman, 2004b)—emphasizing the importance of the practical-intellectual ecology of the FCS discipline. It is these sorts of learning principles that support the critical sciences perspective in FCS and subsequently develops the capacity for rigorous practice in FCS.

Summary

This effort to systematically define rigor is an attempt to provide substance to this elusive notion that recurs—without definition—throughout both federal and state CTE legislation. While Missouri, for example, aims to "ensure that students who participate in CTE programs are taught to the same *coherent and rigorous* content aligned with challenging academic standards *as are taught to all other students*" [emphasis added] (Missouri Department of Elementary and Secondary Education, Division of Career and Technical Education, p. 6), it simultaneously suggests that CTE disciplines do not currently offer coherent and rigorous curricula to their students. In relation to FCS, the findings presented suggest otherwise: the FCS discipline has the capacity to exercise rigorous practice that will strengthen the learning outcomes of secondary and post-secondary students.

By drawing on the work of Biggs and Büchler (2007) who examined the notion of rigor as it applied to their concerns for practice-based research in the field of design, it was determined that rigor is found in the research process and consequently the practice of a discipline. For these authors, it is understood that rigorous practice is context-specific, and rests in the validity determined by the appropriateness of the practice or method to addressing an issue or answering a particular question. Additionally, the authors contend that validation of rigorous practice is determined, standardized, and otherwise evaluated by the disciplinary community, who can best judge the appropriateness of the practice or method for addressing the problem or question.

When applied to the discipline of family and consumer sciences, the equivalency between Biggs and Büchler's (2007) understanding of practice and the FCS understandings of both the practical-intellectual ecology and practice-based nature of the field become clear. Stemming from Biggs and Büchler's (2007) conclusions, parallels are drawn to the FCS discipline. It is argued that rigor not only originates from the discipline's practical-intellectual ecology grounded in critical sciences perspectives, but also from the substance of the FCS practitioner's practice

including his or her critical studies surrounding FCS, the ability to stir concern for the multidimensionality of issues, the exercise of intellectual dispositions, and the critical sciences-based capacity to foster *praxis* among students.

As federal and state mandates suggest that secondary and post-secondary CTE programs must offer rigorous curricula, it is crucial for FCS teacher educators to ensure that initial certification programs educate individuals capable of rigorous practice. Consequently, it is recommended that post-secondary programs include formation of a practical-intellectual community that promotes examination of practical problems pertinent to FCS and that new practitioners develop the mindset for practical reasoning necessary for addressing such problems. Understanding that the relationship between practical reasoning and acquisition of intellectual dispositions hinge on pedagogical reasoning, it is likewise recommended that FCS pedagogy fosters an understanding of the primacy of the intellectual nature of teaching itself.

While FCS practitioners can agree that fulfilling the spirit of Perkins 2006 is important, perhaps more significant are the implications for the FCS discipline itself. By focusing on the critical sciences perspectives central to FCS that were espoused by Marjorie Brown 25 years ago and echoed by many other scholars since that time, the FCS discipline is positioned to demonstrate the congruity among its aims and purpose, discipline, practice, and practical-intellectual ecology that eluded the profession since its inception 101 years ago. As the 21st century unfolds, it would be appropriate for FCS to be recognized as the discipline that *stirs* intellectual concern for quality of life issues that subsequently address inequalities among individuals, families, and communities, thus realizing the call for *praxis* made by Brown, Paolucci, and others.

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Identification and Comparison of Fabric Properties in the Age of Digital Communication

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The use of technology in apparel and textile sectors has been increasing in both academia and industry. This study was conducted to identify the impressions of fabrics presented in three different media including in-person fabric presentation, flat digital photographs, and draped digital photographs over a dress form, and to compare the differences in the responses to them. The serviceability concept as defined in established literature was used to categorize responses. Ten fabric samples were viewed by sixty-seven college students. They were asked to note their impressions of fabrics through open-ended questions at the beginning and end of the semester, rotating the presentation medium. Responses fell into serviceability categories and patterns emerged that show differences given the presentation medium.

The use of technology in apparel and textile sectors has been increasing in both academia and the textile and apparel industry, allowing less face-to-face interaction to teach, sell, and present the product. In academia, distance education has been increasing and online education has grown at a rapid pace. Doyle (2009) noted that in the middle of the 1990s there were too few courses to count online. By 2002, 1.6 million students were taking at least one online course and in the fall of 2007 there were 3.9 million students. Researchers have tried to enhance and examine the learning experience of on-line education. Lo, Chang, Tu and Yeh (2009) developed a web-based history education system to increase the understandability of history learning materials by testing its effectiveness in learning in terms of perceived ease of use, perceived usefulness, attitude to use, intention to use, recall of websites, and perceived usefulness of assistant tools. Cohen, Beffa-Negrini, Cluff, Laus, Volpe, Dun and Sternheim (1999) reported on the success of a Nutrition Science Online course that included a syllabus, web-links, threaded discussions, e-mails, a resource page, and a place to submit assignments online. The course was successful in increasing secondary teachers' knowledge of nutrition science and comfort in using computers.

Since online teaching has emerged, Family and Consumer Sciences (FCS) professionals have questioned the benefits and drawbacks of online education. Reiboldt (2001) discussed the positive aspects of distance education versus the traditional classroom for FCS educators and students, including increased student interaction with deeper responses via e-mail and greater teacher consideration of questions posed, better student-student interaction, ability to hire a variety of professors with specific expertise, reaching un-tapped audiences, greater profits, and better records of class activities. The drawbacks of online education sited were a possible loss in faculty, costs and energy to transform a class online, lack of face-to face contact, ethical issues (e.g., scams, cheating) emerge, and systems failures. Reiboldt (2001) encouraged FCS teachers to develop online classes despite the drawbacks, calling for professionals to work together in implementing online education.

FCS areas such as interior design, FCS education, foods and nutrition, and apparel design and merchandising focus on skills and knowledge related to physical objects. The FCS competencies demonstrate this focus. In the area of apparel and textiles, FCS teacher competencies requires the ability to evaluate performance features of fibers and textiles; analyze the design, use, care, and construction of apparel and textile products; apply color schemes and theory, relate the psychological, physiological environmental trends; and apply principles and elements (Botine, 2008). Such competencies require accurate depictions of the apparel and textile product regardless of method of communicating (e.g. electronically, in person). Lee (2002) further noted that the apparel and textile companies for FCS professionals should include more construction skills, which requires further knowledge of textile use and properties that aid in construction (e.g. drape ability, mold ability). These characteristics are difficult to communicate online as demonstrated in an online experiment where students preformed a draping task better when the teacher was physically present than when the instructor presented the same instruction by video tape (Saiki & McFadden, 2005).

Online education has been practiced in apparel and textile sectors even though presenting clothing and textiles has unique issues in online presentation, such as its dependency on tactile and visual properties. Teaching through multimedia has been developed and practiced in classes with various textile and apparel subjects including textiles, apparel design and production, and merchandising. Botkin, LaBat and Hokanson (2001) developed computer aided instruction module to teach an advanced apparel construction technique and evaluated participants' performance that resulted in no significant differences between traditional lecture and computer aided instruction module demonstration. Chen (2004) incorporated online teaching for an apparel quality analysis class, and evaluated the students' performance and teaching assessment, and questioned factors that affect students' performance in an online course. These included the independent nature of online learning where students need to investigate information independently. The authors suggest technical training prior to taking the analysis class. With this increase in use of apparel and textiles in digital medium and a need for FCS professionals to understand the many dimensions of apparel and textiles, the question emerges as to how digital media varies from face-to-face, hands-on representation and how the fabric product effectively can be represented online.

There have been many studies that assess textile properties using objective and subjective ways to help choose appropriate textiles for the production of clothing (Luible, Varheenmaa, Magnenat-Thalmann, & Meinander, 2007; Ohta, Saeki, Yamada, & Nishimatsu, 1998). These have been developed with actual access to the textile. Researchers and industry professionals have examined different attributes of the textiles in apparel through different tests that incorporate physical handling of the garment as well as surveying user perspectives (Abraham-Murali & Littrell, 1995; Branson & Nam, 2007; Eckman Damhorst & Kadolph, 1990; Kadolph, 2007). There have been general frameworks created to assess the apparel product as a whole, as well as specific to fabrics. While there has been formal research to identify user perceptions of the apparel product, there has been limited research that has focused on the fabrics of the apparel product (DeLong, 1998; Kadolph, 2007). A small number of research studies that capture attributes focused specifically on the fabric in apparel in the words of the end user have been performed. In addition, while there has been some research regarding presentation- catalog versus physical- influences perception of the apparel product, there exist little, if any research that identifies perceptions of the apparel and textile product characteristics in consideration of the recent and contemporary methods of presentation, such as the Internet. The spectrum of

fabric properties as recognized by fabric and clothing consumers' needs to be explored to deliver the essential properties through digital media and to avoid missing critical user observations for successful learning, presentation, and use of the textile product.

Literature Review

Assessment of textiles and apparel product has occurred in multiple levels of industry. Identifying and categorizing relevant attributes and properties of textiles and apparel products have been examined by multiple researchers. As the presentation style changes, especially due to the development of technology, the product perception becomes an important topics to address. The following review of literature examines research related to current assessment tools of apparel and textile attributes, apparel attributes, fabric attributes, textile serviceability concepts, and the impact of technology on the perceptions of the product presentation.

Assessment of Textile and Apparel Product Attributes

Attributes of textile products can be categorized into 1) objective measurements under controlled laboratory settings and 2) subjective evaluations from an observer. Mechanical properties such as durability are usually measured by objective methods using specific instruments based on developed testing methods such as ASTM standards (American Society for Testing and Materials) and ISO standards (International Organization for Standardization). Visual and tactile properties are mainly evaluated through the feedback of an observer. Subjective criteria are a result of many complex factors including the consumer's underlying values and attitudes, stored information and experience, and various psychological, sociological, and economic influences. Therefore, development of models of the apparel purchase process is a challenge (Jenkins & Dickey, 1976). There are several researchers (Abraham-Murali & Littrell, 1995; Eckman et al., 1990; Kadolph, 2007) who have identified the attributes of apparel and textile products, providing a rich starting point by which to assess the consumer's perspective.

There exist multiple potential groups of people who evaluate the textile properties in the textile and apparel industry. There exist various potential purchase decision makers in the fashion industry from product development and distribution to the consumers. For example, fibers can be purchased by yarn manufacturers or fabric manufacturers who produce non-woven fabrics. Yarns can be purchased by fabric manufacturers to produce fabrics, yarn retailers as a wholesale, or purchased by individual hand-knitter/weavers through retail stores. Clothing manufacturers purchase fabric to make garments, and fabric can be purchased by fabric retailer stores to sell to either manufacturers or individual dress makers. Clothing can then be purchased by either retailers or individual wearers. Figure 1 below summarizes these potential purchase decision makers at each production and distribution stage in the garment product development procedure. As online clothing retailing is increasing, the clothing consumers have frequent opportunities to assess fabric properties based on indirect subjective judgment including browsing photos of flat fabric swatches, fabric swatches in draped form or clothing photos made from that fabric along with additional written product information such as fiber content provided by sellers.

Figure 1. Possible purchase decision makers for fabric and garment merchandise

Garment Product Development Stage	Fiber	Yarn	Fabric	Clothing
Purchase Decision Maker	Yarn manufacturer Fabric manufacturer	Fabric manufacturer Yarn retailer Hand Knitter/Weaver	Clothing Manufacturer Fabric retailer Dress-maker	Wearer Retailer

In educational institutions, especially in fashion programs, the instructors are trying to convey their expertise and knowledge in different subject areas including textiles, pattern making and construction, history of dress, CAD (computer aided design) and so on. There are many opportunities to present fabric and clothing items to the students. As distance education is increasing, the use of digital media to present their expertise is increasing, thus conveying fabric properties through digital media in a manner as close as possible to the in-person presentation is important.

Apparel Product Attributes

There are many descriptive frameworks for analysis of the physical, performance, and aesthetic features of the apparel product (Brown & Rice, 2000; DeLong, 1998; Fiore & Kimle, 2006). There has also been formal research conducted to identify the properties important to consumers when they are making purchasing decisions. Eckman et al. (1990) noted that up to the point in time when the article was published. Much of the literature about the apparel product was descriptive. Using scientific methods, they sought to build a model about how consumers utilize the great amount of information available at the point of purchase. They found across 21 studies, 35 extrinsic and 52 intrinsic characteristics influenced consumers' motivation to purchase. Extrinsic characteristics are properties that when altered do not change the physical product (e.g., price), but may change viewer perception of the product. Intrinsic characteristics are properties that when altered change the physical product (e.g. color), and may also change the viewer perception to the product. The authors identified four categories of product characteristics from a review of literature including 1) product composition, 2) performance, 3) quality, and 4) sex appropriateness. The majority of these studies were quantitative, and most have pre-selected scales. The use of pre-selected scales has been criticized for reflecting what the researcher thinks is important to the consumer rather than allowing the consumer to choose what is important (Webb, Campbell, Schwartz, & Sechrest, 1966). The disadvantage of free response is that the consumers may not be aware of the criteria (c.f. Eckman et al., 1990). Comments by the consumer provides a less biased perspective of product characteristics as there is less reinterpretation of their thoughts into scales (Damhorst, 1985; Ericsson & Simon, 1980; Fishbein, 1971).

Methods of identifying product characteristics have also been examined in that many use stimuli, such as the actual product or a product visual to evoke perceptions. Holbrook (1983) found that the tactile use of an actual sweater was more influential on assessing product characteristics and that some methods could require actual viewing on the body to assess lines, colors, forms, and other visual cues. Holbrook (1983) also discussed the influence of the retail setting in which the product is found. Eckman et al. (1990) asked shoppers to fill out a survey

about a garment they were going to purchase. The participants were asked to try on the garment before filling out the survey. They asked the participants what they liked and disliked about the product. The findings indicated that participants paid attention to intrinsic cues including aesthetics (color/pattern, styling, fabric, uniqueness, and appearance), usefulness (versatility, matching, appropriateness, and utility), performance and quality (fit, comfort, care, and workmanship).They also identified key extrinsic cues (price, brand, and competition at other stores) important to them. Styling, color/pattern, fit, fabric, appearance, and price were most frequently mentioned. The participants were concerned about performance and quality related to fit. Using garments to match a wardrobe, appropriateness, utility, uniqueness, brand and competition were mentioned infrequently. When discussing general purchasing (rather than focusing on a specific item), workmanship and care were discussed often and color/pattern was mentioned less than other characteristics. Fabric ranked fourth in the criteria of purchases and third among non-purchases. The authors developed a model of decision making where at the interest phase, color, pattern, style, and fibers and fabrics attract a customer. At the second phase color and pattern, fit and appearance on the body were important considerations. Country of origin, brand, and workmanship had little influence on purchasing, and the influence of price depended on the store type.

Abraham-Murali and Littrell (1995) conducted five focus groups with 31 female consumers using catalog photographs and narratives as stimuli. The authors sought to generate a comprehensive list of apparel attributes grounded in consumer vocabulary and to arrange them into themes and levels. They also wanted to examine attributes given the different types of retailers, from consumer in-house purchases (on hand purchase) to photographs in a catalog. Four general themes (physical appearance, physical performance, expressive, and extrinsic) and 79 specific attributes were found. In general participants were most concerned about physical appearance and expressiveness. When physical garments were examined, concern for appearance increased and interest in expressive attributes decreased. With regards to fabric, they found that participants paid attention to the fiber content, fabric weight, and construction/structure. These fabric components together were analyzed equally among participants when viewing the garment and examining actual artifacts. The theme, color/pattern/texture, included specific features solid, color, pattern or figure, trim, and touch, and it was observed more often after examining the physical apparel item. Fabric was also noted at the physical performance level. As a category the fabric included shrinking, hanging well, stretching, wrinkling, soiling, irritating the skin, pilling, softness, warmth/cool, appearance after washing, and global evaluation. The extrinsic feature, price, was assessed while examining the actual garment more often than while viewing photographs. Participants tended to make comments about the physical performance while viewing photographs, rather than after examining garments. They also noted the care (washability, dry clean only, cost in care, removing stains without affecting fabric, need for ironing, and easy care) with more comments made while viewing the catalog photographs.

Fabric Product Attributes

Textile properties can be measured through various methods including objective measurement, subjective measurement, assessment instrument, and test methods such as the ASTM and ISO standards. For example, **t**here are primarily two systems for evaluating the overall fabric quality based on mechanical property tests of fabrics including the Kawabata evaluation system for fabrics (KES-F, later named KES, FB) and the FAST system. The former system was developed to predict feel, hand, and appearance of fabrics. The latter system is the

measure of fabric for assurance of specific use by simple testing (FAST) system. It is a simpler alternative to KES (Branson & Nam, 2007), however, the use is limited to textile expertise. In Business to Business practices, it is common to present the visual product images and product information online then send a sample to the consumer as requested. As with the apparel product there is a general framework to analyze textiles. Kadolph (2007) provides guidelines to examine the textile properties in terms of the framework that serve the end-user's needs (see Table 1).

Textile Properties and Serviceability

"Serviceability describes the measure of a textile product's ability to meet the consumers' needs" (Kadolph, 2007, p.11). The emphasis is on understanding the target market and relating needs of the market to product serviceability. The serviceability concepts that are used to organize the textile information are aesthetics, durability, comfort and safety, appearance retention, care, environmental impact, and cost. Descriptions for each of the serviceability properties are shown in Table 1.

Table 1
Descriptions and Sub Properties of Serviceability Properties (Kadolph, 2007)

Serviceability Category	Descriptions (Kadolph, 2007, p.12)	Fabric Properties
Aesthetic properties	Attractiveness or appearance of a textile product. Does the item look pleasing and appropriate for its end use? Does it make the right statement for the target market?	Luster, drape, texture, hand
Durability properties	The manner in which the product withstands use. That is, the length of times the product is considered suitable for the use for which it was purchased. Will the consumer be satisfied with how well it wears, how strong it is, and how long it remains attractive?	Abrasion resistance, flexibility, tenacity, elongation
Comfort and safety properties	The way textiles affect heat, air, and moisture transfer, and the way the body interacts with a textile product. Its ability to protect the body from harm. Is this item comfortable for its end use in terms of absorbency, temperature regulation, hand, etc? Will its comfort change with use or age? How does it feel? Is it safe to use or wear?	Absorbency, heat or thermal retention, heat sensitivity, density or specific gravity
Appearance-retention properties	How the product maintains its original appearance during use and care. Will the item retain its new look with use and aftercare? Will it resist wrinkling, shrinkage, abrasion, soiling, stretching, pilling, sagging, or other changes with use?	Resiliency, dimensional stability, shrinkage resistance, elasticity or elastic recovery

Care properties	Treatment required to maintain a textile product's original appearance and cleanliness. Does the item include a recommended care procedure? Is the care procedure appropriate to maintain the product's new or nearly new look? Are these recommendations appropriate considering its end use, cost, and product type?	Dimensional stability, shrinkage resistance, elasticity or elastic recovery, heat sensitivity
Environmental effect properties	Effect on the environment of the production, use, care, and disposal of textiles and textile products. How has the production of this item affected the environment? Can this product, its components, or its packaging materials be recycled? Does the product or its packaging contain any recycled materials?	Toxicity, sustainability
Cost properties	Amount paid to acquire, use, maintain, and dispose of a product. How much will it cost to care for this product during its lifetime? Is the cost reasonable given the product's inherent attributes?	Cost, price

The Impact of New Technologies on Product Perception

As technology and distribution infrastructure are developing, the presentation method for textile and apparel product is evolving. Consumers are becoming familiar with browsing online images. Luckin (2009) examined technology use among middle school students and found that 74% had at least one account within a social network. These learners tended to primarily share photographs followed by music, while a few said that they uploaded videos. In business practices, more and more consumers in both Business to Consumer and Business to Business are participating in purchasing fabric and clothing merchandise through the Internet. As discussed above, Abraham-Murali and Littrell (1995) found that consumers pay attention to different textile properties and make different purchasing decisions dependent upon the medium by which the product is presented. They found differences in consumers' responses to catalogue images and physical observation of the apparel product. Therefore, it can be reasoned that the Internet images may evoke different observations about the product. In addition, there has been some evidence of the difficulties of communicating physical properties of apparel through an online medium in the e-learning literature. Communicating draping skill on-land versus electronically has been examined by McFadden and Saiki (2005), and the results showed that the on-land instruction resulted in a more accurate completion of a draping task than when a group of students viewed a simulated e-learning version of the task. The authors suggested that e-learning information apparently needs to be supplemented with clear written guidelines, and suggested continual testing of e-learning methodologies.

Methods

Purpose and Objectives

The purpose of this study was to identify the recognizable textile properties from different presentation media and compare the differences among them. The objectives of this research were to:

1) Identify the properties of fabrics presented in three varying media including in-person, flat digital photograph of fabric lying flat (referred to as 'flat photos' here after), and digital photograph draped over the dress form (referred to as 'draped photos' here after), guided by the serviceability frame (Kadolph, 2007),
2) Compare the differences in the responses among the three media, and
3) Compare the number of students' comments for each presentation media under each property category.

Population

The population of this study was a group of students, both novice users and experts of fabrics who had an opportunity to view and assess fabrics presented in different methods.

Sixty-seven college students (mostly majors in apparel design and merchandising) participated in this study at a Midwestern university in 2008. The students were enrolled in three classes; two introductory classes about textiles and an apparel analysis class. These students were chosen because at the beginning of the semester they represented individuals who were novices at textiles and at the end of the semester were experts. In grounded approach methodology, the size of the sample is determined by when the topic discussed by participants has reached theme saturation. Typically 8 to 24 participants have been estimated as the number that results in theme saturation for most topics (Riley, 1996). Each class included 20 to 30 students, which is enough for theme saturation. After collecting open-ended data from students, data were analyzed using a grounded approach.

Three Presentation Media Styles

The three different presentation media styles of selected fabric samples were the independent variables. Ten fabric samples with a wide range of textile properties were selected by the researcher and were prepared in three different ways. The first presentation style was the actual fabric sample. The fabric samples were from one-half to one yard in length. They were shown to the students, so that students could touch and feel the samples. The second presentation style was a digital photograph of a flat fabric sample. To prepare this second presentation style, 10 fabric samples were laid flat on a table and photographs for each sample were taken. Students were able to view these samples. The third presentation style was a digital photograph of a sample draped over a dress form. For this third style, the same 10 fabrics samples were draped on a dress form and photographs of each sample were taken. The description, both flat and draped photos of 10 samples used for this study were presented in Table 2.

Table 2

Ten Fabric Samples Shown to the Participants

Sample	Descriptions	Flat photos	Draped photos
Sample 1	Light blue acetate lining-type fabric		
Sample 2	Red knit velour with attached sparkles		
Sample 3	Green cotton jersey with polka-dots		
Sample 4	Cotton weave with flower print		

Sample 5	Coarse net nylon		
Sample 6	Fluffy grey wool knit		
Sample 7	Natural linen		
Sample 8	Grey wool weave made from boucle yarn		
Sample 9	Sheer nylon weave		

Sample 10 Blue herringbone wool blends  

Procedure

Ten fabric samples with a wide range of textile properties were presented to the 67 students at the beginning and at the end of the semester. At the beginning of the semester, each class was shown fabric samples presented by different methods including, in-person presentation, digital flat photographs of fabric samples, and digital photographs of samples draped over a dress form. Participants were asked to write any kind of impressions they could think about while viewing each fabric sample presented. They were allowed to view the fabric samples as long as they wanted and the instructor was not present when responses were written. At the end of the semester, identical fabric samples were presented in the same manner, but the presentation style among the classes was rotated. Each student group assessed the fabric in a different presentation style (digital draped, digital flat, or in person) at the beginning then at the end of the semester. After collection of the participants' impressions for each sample (multiple comments were allowed), responses were analyzed through an open coding process where word phrases or clusters of word phrases were constantly compared for meaning. Grounded theory methodology was used to analyze data. The grounded theory methodology involves constant comparison of one participant's responses, or in this case, written statements with another to identify themes (Wells, 1995). Similarities and differences were noted, resulting in theme categories to explain the phenomenon or behavior (Strauss & Corbin, 1990).

The seven property categories in the serviceability concept were adopted to categorize the responses from the participants and compare them among different presentation styles as a starting and comparison point in the analysis. Serviceability describes the measure of a textile product's ability to meet consumers' needs in use of textile material and consists of seven categories including aesthetics, durability, comfort, safety, appearance retention, care, environmental impact, and cost properties (Kadolph, 2007, Presented in Table 1). Word and word clusters were placed in an appropriate category under the serviceability framework with a code indicating the participant, the enrolled class, and pre- or post-class completion. Similarities and differences were noted, resulting in theme categories to explain the phenomenon or behavior (Strauss & Corbin, 1990). The ratio of students commented each serviceability property was counted for comparison purposes.

Result and Findings

Identification of Perceived Fabric Properties (objective 1)

Analysis of all of the data together revealed that students placed most of the properties under seven serviceability concepts identified by Kadolph (2007). Overall, the comments from the students were well distributed over six of the seven textile serviceability property categories

that included aesthetics, durability, comfort and safety, appearance retention, care, and cost. The only serviceability property not expressed was environmental effect. There were other comments besides the serviceability properties, and those were categorized into 'other.' The 'other' category included fiber/yarn/fabric content, name, and structure, overall evaluation/ emotional responses about the presented textiles and end use. Specifically, the responses to the open-ended questions, emotional (e.g., happy, yuck), fiber component (e.g., linen, synthetic fiber), fiber structure (e.g., knit, herringbone), fabric name (e.g. denim, muslin), and specific use (e.g. prom dress, fish net) varied from Kadolph's (2007) serviceability properties.

Overall Property Identification. The overall responses were analyzed under seven properties. The responses which cannot be categorized into existing category were listed under "others." Table 3 shows the examples of responses under each property. In general, very diverse comments were collected under aesthetics properties. Comments on the durability properties were less varied and occurred less often than the aesthetic comments. Participants' comments were less varied and less frequent for comfort and safety properties. There were comments directly mentioning "comfortable," "uncomfortable," and "snag easily," and "descent ease", those were placed under "others" category. Resiliency, dimensional stability, shrinkage resistance and elastic recovery were subcategories under appearance retention properties, A few other answers under appearance retention properties including "thermoplastic," "stained," "possibility fade quickly," etc. were listed into others under this category. Specific care methods were mentioned by participants. For the cost properties, extrinsically, students discussed the cost of the fabrics as well as in light of how difficult the fabric was to sew.

There were several clusters of answers besides serviceability categories that were sorted into: fiber/yarn/fabric name, fiber/yarn/fabric contents, fiber/yarn/fabric structure, overall evaluation/ emotional responses, and end use. It was noteworthy to have variety of answers in "others" category. Those comments were very specific and lots of them were based on their previous experience as well. Multiple comments were found directly commenting its' end use.

Table 3
Examples of Responses under Each Property

Serviceability Category	Fabric properties	Responses
Aesthetic properties	Luster	shiny, luster, sparkles flash, dull
	Drape	drapable, drapes well, fluid drape, decent drape, drape not good, can't drape well
	Texture	rough, smooth, fuzzy, uneven, bumpy, wiry, felt like, bumpy, textured
	Pattern	polka dots, floral, pattern, busy, complicated pattern, dizzy lines, fishbone, marble like
	Hand	soft, smooth, soft, itchy, fuzzy, rough, fells like taffeta, velvety
	Color	dull, neutral, white, red, blue, lilac, purple, grey, cream, green, beige, grey, tan, iridescent, orange
	Light	light, heavy

	Thickness	thick, thin, see through
	Sounds	sounds, crunch
	Smell	Smell
Durability properties	Abrasion	abrasion
	Flexibility	stiff, flexible
	Tenacity	strong, tough
	Elongation	stretch
	Others	durable, poor durable, easily frays, don't tear, looks like it could be unravel on the ends, frayed edge
Comfort and safety properties	Absorbency	
	Thermal Retention	warm
	Others	comfortable, uncomfortable, snag easily, descent ease, tight, tight clothing
Appearance-retention properties	Resiliency	poor resiliency, winkles
	Dimensional stability	stable
	Shrinkage resistance	would keep its shape
	Elasticity or elastic recovery	elastic recovery
	Others	thermoplastic, stained, possibility fade quickly
Care properties	Treatment requirement	machine washed, ironing, dry clean only, liquid wash, washable, sensitive to washing and care, hide soil, hard to take of, easy to wash
Environmental effect properties	Toxicity, sustainability	no responses
Cost properties	Cost, price	expensive looking, high quality, moderate cost, moderate quality, less quality, low price, cheap, difficult to sew, cost more money for manufactures, hard to match up seams, be careful of the grain, difficult to work with sewing wise
Others	Fabric name, content	satin, velvet, polyester, nylon, acetate, synthetic cotton, spandex blend
	Fabric structure	filament, staple, loop curl, boucle, knit, woven, pile, velvety, non-woven
	Overall Evaluation/ emotional responses	feel bad, feels alright, decent feel, fun, cozy, hideous, bland, grandma, 1950s, during the 1970s
	End use	dinner placemats, canvas, lining, curtains, bag, dinner placement, summer wear, nurse's uniform

Media Comparisons for Identified Properties (objective 2)

Several remarkable differences among the different media presentation styles were observed in each property category.

Aesthetic properties. For aesthetic properties, observations involving luster, texture, pattern, hand, color, weight, thickness, sound, and smell were discussed among the groups that were presented in-person, flat digital photograph and draped digital photograph presentations. In general, in-person and draped photograph presentations evoked more comments about aesthetics, with pattern, hand, and color. In addition, the comments used words that showed 'assumption' when observing the digital photographs of the draped fabric samples. For example, 'probably' feels rough, 'looks like it could be soft, and 'I would assume would be very soft'. The meanings of the responses in each category were similar among all media. Comments under the category, ***Luster***, were expressed as "shiny," "sparkly," and similar words. A comment such as 'dull' was categorized under ***Luster*** since it indicates a lack of luster. Both in-person presentation and draped photos evoked comments about being dull. There were not remarkable differences in the comments among the three media about ***luster, light, and thickness***. Interestingly, there was not an answer found with the in-person presentation mentioning '***drape,'*** while there were several answers found for both digital versions of the fabric (flat and draped over a dress form). Visual ***texture*** comments were focused on visual roughness. Comments, such as "rough," "coarse," wiry," "felt like," "bumpy" and "textured" were commented in-person presentation. Flat photos and draped photos evoked similar comments. Comments in all three groups were similar in regards to ***pattern*** with all discussing polka dots and the complexity of a print. Also, the complexity of the print was stated as busy or complex and the digital versions and participants who viewed the textiles in person discussed the details of the complexity by discussing "dizzy lines" and a "fishbone" or "busy" pattern. Possibilities for misleading information on pattern were recognized. For example, there was an answer saying "marble-like" for flat photos and "denim/dull" appearance for draped photos, which indicates the optical illusion from the blue herringbone fabric. ***Hand*** was common among comments about the fabric displayed in all three of the presentation media. In all three cases, the smoothness, softness, stiffness, roughness, and itchiness of the fabric was noted. All presentations evoked discussion of parallel fabrics to explain hand, such as "feels like taffeta" or "velvety." However, comments related to the hand for in-person presentation were more detailed and specific. Some comments revealed the properties from the experience such as loops on both side. ***Color*** was discussed in response to the three presentation media. Color in terms of hue was discussed by students who were presented with fabric shown in all three media. However, the in-person and the draped photo presentations prompted more variety in hue including "white," "red," "blue," "lilac," "purple," "grey," "cream," "green," "beige," "grey" and "tan." "Purple" was mentioned once in response to the in-person presentation. "Iridescent" was mentioned in response to the flat photo presentation. Possibilities for misleading information about color were recognized as well. For the color, there were students who answered "orange" for one of the fabric samples even though there was not a fabric sample with an orange color; this happened when they were viewed the fabric digitally (flat and draped versions). The original fabric color was rather red (there was no orange fabric shown for this study), and many students answered "red" for the same fabric for the in-person presentation. ***Lightness or weight*** was noted similarly among three presentations, but was most frequently mentioned by participants who viewed the in-person presentation and

the draped photographs of the fabric samples. The flat and the draped digital versions prompted more comments as well as, a comment about a mid-weight. ***Thickness***, from "see through" to "thick" was mentioned in all three samples. ***Sound*** was not discussed by the group of students who viewed the draped digital photos, even though it was mentioned three times for the in-person presentation. ***Smell*** was mentioned once only in-person observations and noted directly as "smell".

Durability properties. In terms of the durability properties, there were not many distinguishable differences among presentation styles recognized for abrasion, resistance, tenacity, and elongation. There were several comments for all presentation styles for ***abrasion***, ***tenacity***, and ***elongation***, but there were no comments about resistance. Several differences among media were found when discussing flexibility and other properties. For the flexibility properties, there was a comment, "stiff" for in-person presentation, and several similar comments looking at flat photos, but no such comment was found for draped images. Other comments related to durability were categorized into ***other***, and "durable," "poor durability," "easily frays," "don't tear," "looks like it could be unravel on the ends," and "frayed edge" were categorized into "other" properties. Durability was recognized among all three presentation styles, but there was remarkable difference in the comments in that is there were a large number of comments about the edge of the fabric (e.g, "fray)." Two comments were found about fraying issues in responses to the in-person presentation and thirteen comments were found in response to the draped photo presentation while there was no comment about fraying from those who viewed photographs of the flat version of the fabric samples. It could be assumed that the photographs of the flat versions of the fabric did not show the edges of the fabric, while other presentations styles showed the edges (See Table 2), therefore the students did not think about commenting on fraying.

Comfort and safety properties. There were not specific differences among the three presentation styles except "tightness." There were two answers including "tight," and "tight cloth" that were found in the responses to those who experienced the fabric sample in-person.

Appearance retention properties. There were no comments found about resiliency and dimensional stability from either in-person or draped photo presentations. One student commented as "poor resiliency", and two students commented "stable" and "would keep its shape" when the fabrics were shown as flat photos. There were several answers for elastic recovery, and wrinkle for all of the presentation styles, but there was not remarkable difference among them.

Care properties. For the care properties, fabric samples presented in flat photos and draped photos evoked more variety in answers than the in-person presentation, even though the types of answers were similar among one another including "washable," "would show water spot," "collects soil," "hide soil," "machine washed," "ironing," "required special care," "hard to take care of."

Environmental effect properties. There was no particular answer related to the environmental effect properties.

Cost properties. Comments such as "quality," "more expensive," "cheap," and "luxurious" were found among all presentation styles. A lot of cost related comments in terms of production process, such as "difficult to sew," "would need to be tightly woven to be durable," "hard to match seams," "does not need to be hemmed," "be careful of the grain," "hard to sew would need a deep fold hem" were collected, especially from the student group in the production analysis class.

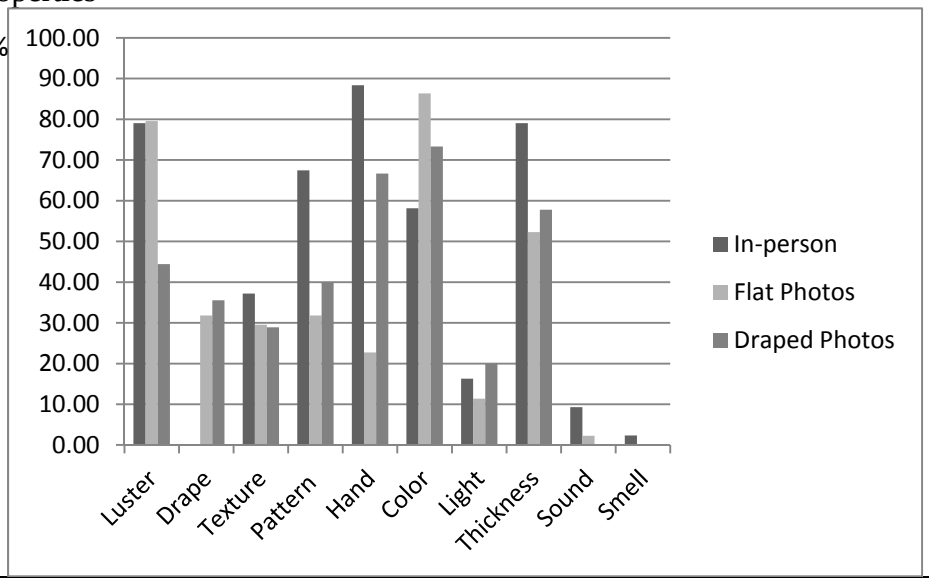
Other. Wide ranges of other properties were distributed quite well among three varying media. There were no remarkable differences among them.

Comparison of Comment Ratio among Three Varying Presentations Media (objective 3)

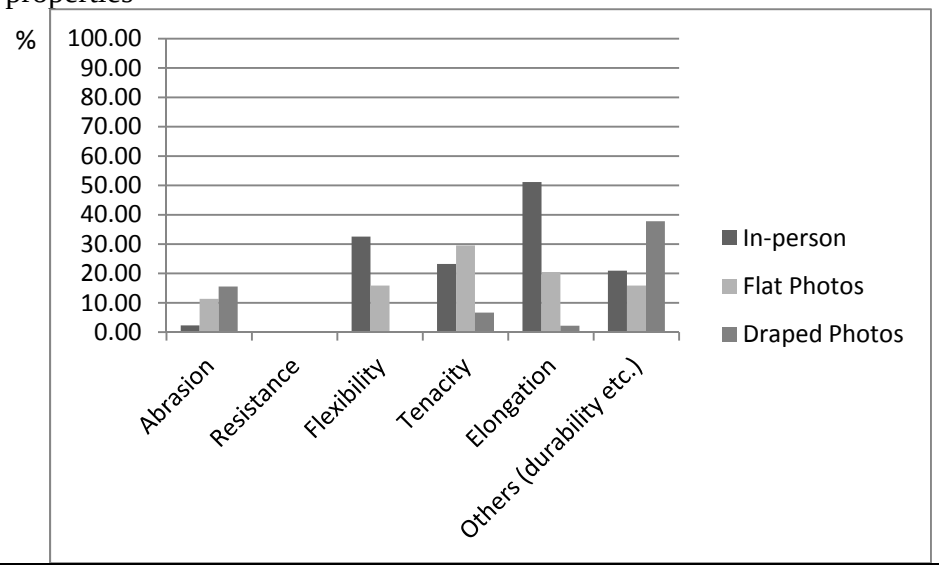
Additionally, the ratio of students answering for each serviceability property categories of comments regarding the fabrics presented in three varying presentations media were calculated to further assess the differences among them. Although a relatively small sample, patterns emerged that show some differences in the media presentation. Figure 2 shows the ratio of students' comments viewing varying media under each sub property category.

Figure 2. Ratio of Comments of Students under Each Property Category

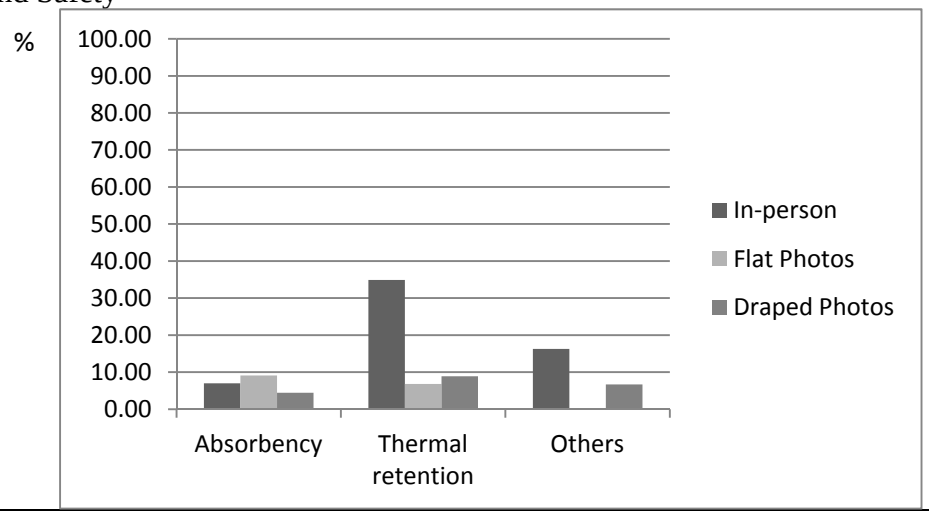
Aesthetic properties



Durability properties

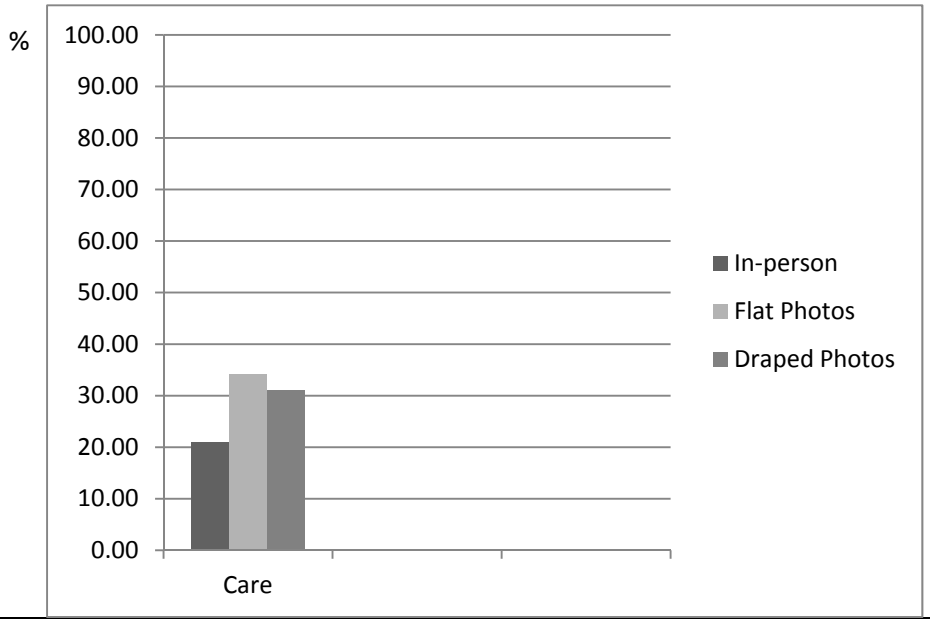


Comfort and Safety

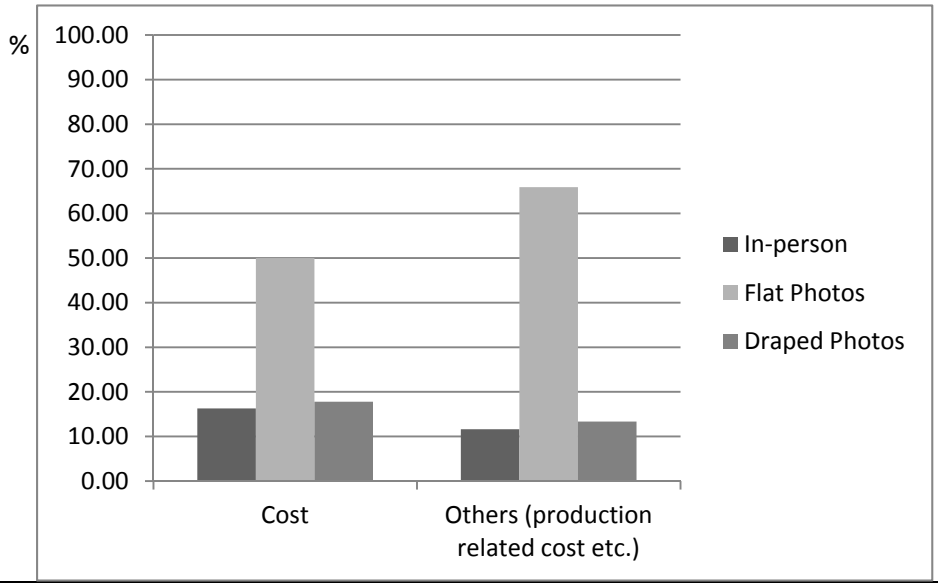


Appearance retention

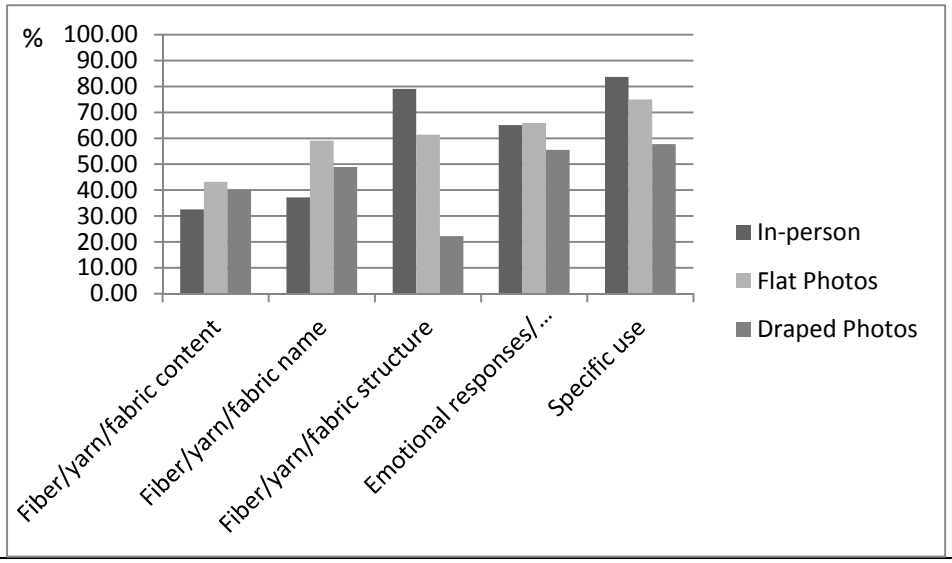
Care properties



Cost properties



Others properties



Note: Environmental properties were excluded since there was no comment in this category.

In general, 'aesthetic properties, and 'others' properties were commented on more than other categories including durability, comfort, appearance retention, care, and environmental effect properties. There was no student comments related to environmental effect. There were several sub categories including drape in the in-person presentation, sound in draped photos, smell in flat photos and draped photos, resistance for all three media, resiliency and dimensional stability in in-person and draped photos, that is inherently consistent to the result of the previous analysis based on the numbers of the comments under each category.

As presented in Figure 2, there were noticeable differences recognized under the aesthetic properties category. More students commented on pattern, hand, and thickness for in-person presentation. Sounds and smell were recognized in very few instances. Sound and smell were mainly recognized when the samples were presented in-person. Flexibility and elongation (stretch), which can be easily recognized in the in-person presentation, were commented on more by students with in-person presentation. Thermal retention (warm, cold and so on) was commented more often for in-person presentation than in other presentation medium as well.

In general, flat photos evoked comments by more students categorized under appearance retention. Elastic recovery and wrinkling properties were commented by more students in flat photos than when viewing fabric draped or in-person. It could be assumed that the flat photos showed detailed wrinkles when the photos were taken as a close shot. There were remarkable differences in cost properties. More students made comments about the cost when the samples were presented in flat photos. A high ratio of students made comments about production related properties, which could be due to the class subject of product analysis.

Conclusions and Implications

Serviceability concepts were useful to categorize fabric properties responses obtained from the open-ended questions. Specific responses including emotional response, previous experience, fiber/yarn/fabric content, name, structure from this pilot study were found other than serviceability category, which also vary from serviceability concepts.

The possibility of leading misconceptions through digital fabric presentation was recognized as well. Multiple students misperceived the blue herringbone wool fabric sample as

denim when it was presented as a flat swatch digital image. In-person presentation evoked experience based comments such as hand, texture, sound, smell, and thermal retention, including warm and cold. In addition, different comments were found depending on the way the fabric samples were prepared and shown. There were no comments of 'fray' for the flat photos since the picture focused on the middle of the fabric, but there were many students who commented 'fray' of edges when the fabric were shown as a whole piece (Figures 2 and 3). Drape related properties were not mentioned when the fabric samples were presented in person. This result illustrates that the presenters need to develop multiple ways to convey the fabric's properties to consumers, in order to minimize the differences between in-person fabric presentation and digital fabric images and to provide full property information that can be missed when it is presented in online.

Identifying critical textile properties from diverse presentation media are important as more FCS classes are taught online. These additional dimensions and associations that viewers have of textiles can be considered in online discussions or in other digital methods of teaching. For example, the FCS teacher could stimulate an online discussion about the emotional response towards the textile and use responses that are analogous to the textile properties to help better explain it.

The instructor in an educational unit needs to try to convey fabric properties effectively through learning materials in different media. Since online presentation has a potential to deliver incorrect information more accurate information and communication methods need to accompany the fabric visual. The FCS instructor can use serviceability concept and other responses besides serviceability concept as a checklist to develop written text that accompanies visuals of textile samples and products. The instructor can also have students answer questions related to the checklist about the fabric samples, so that the FCS instructor can provide the student with the accurate information based on students' feedback. This checklist overlaps with FCS competencies in the apparel and textile areas. Besides collecting textile properties and categorizing them into the serviceability concept, impression frequencies in different property categories were compared. As a result, differences in impression frequencies were found among three media style. Moreover, misperception of textiles was observed when the fabric was presented as flat swatch images (blue herringbone wool fabric sample was recognized as denim).

These results suggest there is a need for instructors to prompt online users to pay more attention to non-visual stimuli either through discussion and/or through written text. The outcomes of the study also suggest that an instructor in an online setting should incorporate a variety of presentation methods of textile samples (flat and draped) to stimulate student responses and that there is a need for instructor's close monitoring of the accuracy of student statements. Levels of education and training were recognized as factors which may influence impressions. Thus, consideration for viewers at different levels of education and training will be needed for further study.

This study has the potential to be developed into a fabric property assessment scale for expert to novice users focusing on serviceability. A larger pool of consumers in various demographic groups including different levels of education, job positions and textile expert vs. novice users can be tested to ensure the reliability of the proposed scale. In addition, different selection of fabric samples can used to confirm the breadth of responses. The information is vital to FCS professionals in adapting their online materials to accommodate middle, high school, college, and graduate student levels.

To further assess reliability, responses to the scales after participants view an actual fabric sample can be compared to the objective measure (e.g. durability) of the fabric sample. These findings can be contrasted to a group that views online representations of the same fabric samples. Such objective measures will identify which fabric characteristics are most affected when presenting textile products online and will further guide which text is needed for clarification of online presentations of textile samples.

The proposed assessment scale can also be used to evaluate effectiveness of learning materials developed by an instructor, as well as the students' achievement after taking certain classes in apparel and clothing areas. This would help to identify effective presentation style in education without missing the critical fabric property information that needs to be delivered to students. The study may also stimulate the development of scales of other FCS topics where the physical object is the focus, such as food, upholstery, and furniture. Such studies are important in understanding similarities and differences in online presentations given the different areas within FCS.

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Family and Consumer Sciences Teacher Use of Technology to Teach Higher Order Thinking Skills

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Family consumer sciences high school teachers from the Northern Illinois region were surveyed on their use of technology to teach higher order thinking skills (HOTS). This study determined if teachers had financial support, time to plan, computers, technology training, and confidence as they apply HOTS to the use of technology. A modified version of Croxall's (2002), Technology Survey for Family and Consumer Sciences Teacher Educators, was used to gather data via Survey Monkey. The study found that 89% of teachers were using technology to teach HOTS and were sufficiently supported and trained.

This study determined how technology was being used in family consumer sciences (FCS) high school classes based on the International Society for Technology in Education's (ISTE) National Educational Technology Standards (NETS) and Performance Indicators for Teachers. Bloom's (Anderson & Krathwohl, 2001) higher order thinking skills of analysis, synthesis, and evaluation, were of specific interest and how they are being taught using technology. The ability to apply technology to teach higher order thinking skills is expected of preservice FCS teachers upon entering the field (Croxall, 2002). Specific technology skills are also expected of high school students (International Society for Technology in Education, 2008a). The curriculum in FCS courses is created to teach authentic real-life lessons, which are immediately applicable outside of the classroom. This study investigated whether FCS high school teachers felt sufficiently supported by their school in the use of technology and if they felt they had received enough technology training to instruct their students.

Literature Review

Teachers use computers to instruct students, handle administrative tasks, and correspond with parents (Rother, 2004). The International Society for Technology in Education (ISTE) has devised *National Educational Technology Standards and Performance Indicators* for teachers worldwide. Included in the standards is the use of higher order thinking skills. Teachers have been trained for many years to use Benjamin Bloom's taxonomy of higher order thinking skills to help their students become critical thinkers (Huitt, 2011). This review of literature will focus on how teachers are expected to incorporate critical thinking skills into their lessons. The field of FCS, or what used to be called home economics, has been transformed as the configuration of today's families has changed and new issues have arisen. For example, the number of divorced parents has increased along with the number of teenage pregnancies. What does the field of FCS teach and what innovations are teachers using? The latest technology used in this field will be discussed.

Background International Society for Technology in Education

The National Council for Accreditation of Teacher Education (NCATE) and the International Society for Technology in Education (ISTE) created separate technology standards

for teachers and students. The standards (NETS-T) and Performance Indicators for Teachers are as follows: "Facilitate and Inspire Student Learning and Creativity; Design and Develop Digital-Age Learning Experience and Assessments; Model Digital-Age Work and Learning; Promote and Model Digital Citizenship and Responsibility; Engage in Professional Growth and Leadership" (International Society for Technology in Education, 2008b, p. 1). There are six standards for students. The student standards are: students will (a) demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology; b) use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others; c) apply digital tools to gather, evaluate, and use information; d) use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources; e) understand human, cultural, and societal issues related to technology and practice legal and ethical behavior; and f) demonstrate a sound understanding of technology concepts, systems, and operations (International Society for Technology in Education, 2008a, p. 1). The question is: how do these standards relate to Bloom's higher order thinking skills?

Technology and Higher Order Thinking Skills

Benjamin Bloom (Huitt, 2011) created a hierarchical taxonomy to describe levels of thinking. His theory is well known and both taught and used by teachers worldwide. The top three levels, analysis, synthesis, and evaluation, require higher order thinking skills (Johnson & Lamb, 2007). Technology has been shown to improve and teach higher order thinking skills. Carr-Chellman (as cited in ChanLin, Huang, and Chan., 2003, p. 14) explained how an online course should provide students with substantial latitude and initiative to pursue their own goals. These tasks require the higher order thinking skills of analysis, synthesis, and evaluation. Teachers and parents must instill in students the desire to be an educated person. This drive makes students excited to learn new topics and reach for greater understanding of the world. Teachers are incorporating both higher order thinking skills and the ISTE standards in their lessons according to the examples below.

Technology in the Curriculum

Teachers may feel that they have to add technology into their already-set lessons as an extra lecture or special occasion rather than fully integrating it. As one teacher complained, "How can I realistically add computer activities to [an] instructional day that is already full?" (Labbo, 2006, p. 21). Rather than an addition, technology should be a "partner in teaching and learning" (Levin & Wadmany, 2008, p. 251). One's content does not necessarily need to change but the way in which it is presented can be restructured (Voogt & Pelgrum, 2005). When the teacher is familiar with using technology, he/she will be more likely to incorporate it into their daily lessons (Labbo, 2006). Technology is being used in the classroom for teleconferencing between students and researchers in the field, taking virtual field trips, and communicating with students in other countries. Interacting with students their age is a positive energy, which the teacher can use to connect students with their peers across the world. Students then start to realize how similar they are to others and they can discuss issues of common interest. However, one teacher warned, although technology skills are important, students must also learn to be "adaptable, creative, and innovative" (Young, 2008, p. 351).

Labbo (2006) offers a few suggestions for being successful when using technology in one's curriculum. Teachers should demonstrate computer usage throughout the day by completing basic tasks such as typing a letter, looking up the weather, or viewing a news story. This shows students the resourcefulness of computers. In an FCS classroom, this could mean looking up the latest recalled toys, infant mortality rate, or list of recent restaurant closings for safety and sanitation issues. Another suggestion of Labbo's (2006) is to incorporate graphic organizers such as a web graph, videos, pictures, and audio along with written and spoken words. This becomes a stronger lesson for students than having them simply look at plain black and white overhead slides or listen to the teacher lecture (Labbo, 2006).

The use of technology has improved communication between teachers, students, and parents. Many educators are posting their "class notes, homework, assignments, and other information to a school's Web site" (Rother, 2004, Professional Development section, para. 7.). This prevents students who are out sick, especially those with more serious illnesses, from being delayed with schoolwork. Parents can look at each class their child is taking and discover resources to help their student with homework or study for an exam. More parents are using email than telephone to communicate with teachers. Email is useful to send attachments such as a list of assignments the student is missing or the instructions for a project. In addition to the above-mentioned benefits, technology is also being used by teachers to manage students in their classrooms.

Technology and Family Consumer Sciences

Technology is used in a variety of ways in relation to the field of FCS especially as the areas of study are so varied. A number of high school FCS departments around the country have student-run businesses. They may have either a food service or catering business and/or a childcare center. Both businesses use technology in their day-to-day routines. One teacher explained that her school-based restaurant is completely computerized (Thaler-Carter, 2000). Another FCS teacher predicts that with the reality of 24-7 Internet access and other technological impacts, "teaching may become more like coaching, supervision, and guidance rather than actual instruction" (Thaler-Carter, 2000, Technology Plays a Role section, para. 3.).

Family consumer sciences professionals have a responsibility to teach young people and adults to make wise choices with the use of technology. The lack of privacy due to technology is a recent concern. With the advent of online banking and shopping has come the fear that our personal information will be stolen. Many people do not realize all the data that is being collected about them every day. Browsers track which sites consumers visit and then decide which advertisements to show. Students need to be taught to keep their identities safe when using social networks (Makela, 2008). Technology can be used to improve "individual, family, and community functions, and relationships and can be appropriate…or not" (Braun, 2008, p. 1).

Card (2008) gave a symposium titled "Incorporating technology into the FCS curriculum." She explained how she had her students create power point presentations rather than the typical poster. Her students created digital portfolios of their work in her child development, preschool, and parenting classes, which they could then show future employers. Card (2008) is an example of an experienced teacher who is constantly updating her curriculum as the technology and her students change.

A professor explained that a benefit of technology was that it makes the schoolwork students do more authentic, as they can apply it to real-life situations. To make student's class work more worthwhile, students should be sharing what they create with others, besides simply

turning it in to the teacher (Young, 2008). An example of this would be having students create pamphlets about parenting. The students could scan the pamphlets and post them online perhaps as a link from the health department or library. This would educate others about the chosen topics such as adoption, lead poisoning, or breast versus bottle-feeding, and the students would feel that their work was more valuable and therefore they might put forth more effort.

Teacher's Training Using Technology

The main obstacle that prevents teachers…using [technology] in their classrooms is lack of adequate preparation (Levin & Wadmany, 2008, p. 259). As far as training at the college level, only 29% of states had a technology course requirement for new teachers. When any new technology is introduced, schools should at the same time, provide professional development (Zucker, 2004). Klecker, Hunt, Hunt, and Lackner (2003) surveyed of 110 student teachers, found that teachers wanted more training in: "database, spreadsheet, desktop publishing…, digital video, web page development … publishing, [and] content specific software" (p. 8). Similar to students, adults have a variety of learning styles. Teachers must be taught to use technology using a range of methods (Levin & Wadmany, 2008). Some will learn better with written directions and visuals, others by multiple sessions of hands-on experiences. Teachers should not assume all their students are familiar with technology either. It is vital to discover what training one's students require before expecting them to use technology.

Methodology

The purpose of this quantitative study was to determine whether northern Illinois FCS high school teachers felt sufficiently supported by their school and if they felt they had received enough technology training to instruct their students in the use of technology. The study also compared additional factors that may play a role in the case of technology usage. In this study, the dependent variable was support and training in using technology for instruction. The independent variable was, teachers' using technology to teach higher order thinking skills.

The purpose of this study was twofold. First, to determine if northern Illinois FCS high school teachers felt sufficiently supported and trained to use technology and determine if they were actually using technology to teach higher order thinking skills in their classrooms.

Subjects

Research was conducted in the six counties of the Northern Illinois region. Potential participants were 491 FCS teachers from every high school in that region that offered a FCS curriculum. The location was chosen because of the wide range of classes taught throughout the schools in the Northern Illinois region and the variety of student populations in each school. There were 172 total participants, a 37% return rate, who provided complete survey results. The teachers were all certified as secondary level FCS teachers. The majority of teachers attended at least one training session in technology and taught in a suburban school with at least one other FCS teacher.

Survey Instrument

The survey instrument, "Technology Survey for Family Consumer Sciences Teacher Educators," was adapted from Croxall's dissertation work (2002). Croxall (2002) tested the reliability using Cronbach's alpha but did not report the actual number. The original study was designed to help family consumer sciences teachers share lesson plans that teach both technology

and higher order thinking skills. A web site, http://sites.google.com/site/familyconsumersciencesslessons/, was created, that lists the 77 lesson plans used in this study. Participants of the study were emailed the website for use in their lesson planning.

Results

Family consumer sciences teachers were surveyed about their level of support in terms of money, time to plan, and computers, and their training and teacher confidence level in relation to technology. In all cases, over half of participants *strongly agreed* or *agreed* that they did receive enough support or training. In regard to financial support, 87% were satisfied with training, 90%, with time, 65%, and in regards to enough computers and other technology, 72% were content. When asked about their confidence in their ability to teach or demonstrate computer skills in the classroom, 87% of teachers either *strongly-agreed* or *agreed*. In general, teachers do appear to receive adequate support and training, although they could use more planning time for the use of technology. The majority, 96%, reported their computer skills to be from average to very advanced. There was a significant correlation between teacher's confidence with their ability to use technology in the classroom and their self-reported skill level (see Table 1). How these skills relate to use in the classroom was studied next.

The frequency of use of technology in various FCS course was noted in terms of which classes it was modeled by the teachers and/or required of the students. Child Development, Consumerism and Finance, Foods and Nutrition, and Interior Design classes were reported by over 50% of participants as both having technology modeled by the teacher and being required of students. As far as specific hardware technology used in FCS classes, digital cameras and simulator babies were modeled by over 50% of teachers. Simulator babies were the only technology reported being required by over 50% of students. In terms of software, teachers modeled word-processing, desktop publishing, spreadsheet, presentation software, and hypermedia software in over 50% of responses while students were required to use word processing, presentation, and hypermedia software (Word Wide Web searching) at least in 50% of teacher's classes. Teachers' rating of their own ability to use Desktop Publishing and Power Point was significantly related to their requiring students to use these programs. In other words if teachers do not feel comfortable using a particular software, they do not expect their students to use that software either.

The next set of questions related to FCS teachers' observance of the International Society for Technology in Education's National Educational Technology Standards and Performance Indicators for Teachers. Only 15% reported being familiar with the standards, although 52% said they were somewhat familiar with them. In total 90%, of teachers *strongly-agreed* or *agreed* that they did in fact use technology to teach higher order thinking skills and they had enough support and training (see Table 2).

Table 1

Means and t-test Between Financial Support, Training, Time, Computers, Teacher Confidence, and Use Of Technology (Tech) To Teach Higher Order Thinking Skills (HOTS)

	N	Mean	Std. Deviation
Financial Support	168	3.29	.70
Training	168	3.3	.65
Time	160	2.8	.70
Computers	167	2.96	.81
Confidence in Ability	166	3.22	.70
Use of Tech to Teach HOTS	165	3.23	.63

Student t-test for Equality of Means	Test Value = 0 *t*	df	Sig. (2-tailed)
Financial Support	60.625	167	.000
Training	65.187	167	.000
Time	50.987	159	.000
Computers	47.238	166	.000
Confidence in Ability	59.451	165	.000
Use of Tech to teach HOTS	65.784	164	.000

Table 2

Mean and t-test: Use Of Technology (Tech) To Teach Higher Order Thinking Skills (HOTS) and Levels of Support and Training Between "Agree" (3) and "Strongly-Agree" (4)

	Use Tech to Teach HOTS	N	M	SD
Financial	3.00	94	3.24	.68
	4.00	55	3.53	.63
Training	3.00	94	3.26	.62
	4.00	55	3.38	.65
Time	3.00	91	2.79	.66
	4.00	51	3.04	.77
Computers	3.00	93	2.91	.86
	4.00	55	3.13	.79
Teacher Confidence	3.00	92	3.13	.70
	4.00	55	3.42	.66

T-test for Equality of Means	*t*	Df	Sig. (2-tailed)
Financial	-2.502	147	.013
Training	-1.178	147	.241
Time	-2.020	140	.045
Computers	-1.504	146	.135
Teacher Confidence	-2.469	145	.015

Demographic Data

Teachers were asked a few demographic-type questions about their programs, training, schools, and themselves. There was a wide range of courses taught by the FCS teachers who participated in this study. Seventy-one percent of participants teach Foods and Nutrition courses, 46% teach Child Development courses, 29% teach Consumerism and Finance, 27% teach Apparel and Textiles, 19% teach Family Living, and 18% teach Interior Design. These figures overlap as many teachers teach more than one subject. Another 45 respondents wrote the names of one to three courses under the "other(s) please specify" section. Some of these courses included Fashions I and II and Child Development. Participants, for some reason, did not feel comfortable categorizing their course into one of the general categories. Further research might be done next time to determine more precise category names or the wording could have been changed to accommodate a wider range of classes.

A few questions focused on the teachers' technology training. When asked if participants were required to take a technology course prior to graduating from college, less than 50% said yes (47%). The next question followed by asking teachers if they had taken technology related

classes, workshops, seminars, or online sessions since becoming a teacher. Overwhelmingly, this response was yes with 88%. Thirty-five percent of participants reported taking one to two classes or workshops, 42%, the majority, have taken three to five classes, and 23% have taken six or more.

As expected, most of the participants reported teaching in a suburban school (94%). Most of the teachers in this survey have other FCS teachers in their departments; 28% have two to three teachers, 48% have four to five teachers, and 20% have six or more teachers. Regarding the number of students in participants' schools, the majority of respondents, 45%, have 1,000 to 3,000 students. Teachers were asked about the amount of budget money their department receives. Fifty percent of respondents chose "do not know or do not wish to share." One could assume that teachers did not wish to share and that they do know how much budget money their department has but as the question was not separated, it is unclear. According to those who answered with a monetary figure, 38% had over $3,000. A few teachers commented through email that they felt lucky because their department was given much more than $3,000. This was a delicate question and in the future, more research would need to be done if the question were to be pursued.

Conclusions and Implications

The findings from this study are beneficial to teachers. It is encouraging to see that the majority of FCS teachers are already using technology and are teaching higher order thinking skills. Often teachers feel pressured to try new teaching methods or to make sure they are teaching students critical thinking skills. By reading through the questions related to the International Society for Technology in Education standards, teachers might realize that they may already be teaching these skills to their students. The standards portion of the survey can be used as a self-test of one's teaching methods. If there are certain items that a teacher does not *strongly-agree* with that she/he does, then those are items they may wish to learn more about or may wish to try to include in future lessons. Teachers should also make sure they are teaching the ISTE student standards. This study demonstrates that FCS teachers are forward thinking and generally confident in using technology, yet we must continue to learn the latest uses of software, and hardware so that our field stays competitive with other electives and up to date with current knowledge.

Application

The following are lesson plans collected through the author's dissertation. Many more examples can be found online at http://sites.google.com/site/familyconsumersciencesslessons/. An analysis lesson plan may require students to gather data and decipher the meaning of the information. For example, in Life Studies, students analyze their diets using a web program. It shows them their caloric intake, nutritive values and everything they need to know about foods they consume. They then take what they learn and write a paper using the web as their resource" (Hirose, 2009, p. 103). Students using information to create a presentation and a related class activity would require the skill of synthesis. A service learning project requires students in Foods classes to research nutritional needs and problems of seniors. The students are then responsible to plan a nutritious snack that can be served at a nursing home facility that will meet nutritional needs as well as identify any special nutritional needs of some inhabitants (Hirose, 2009, p. 104). When students must explain why they are taking a certain action or the reasoning behind their answer, they are using evaluation. In a parenting class, students take Baby-Think-It-Over home

and care for it for 3 days and 2 nights. They must type [a] summary of events that took place, reflect on their experience, and decide if they are ready to parent (Hirose, 2009, p. 104). This lesson plan included analysis, synthesis, and evaluation. In advanced fashion, students use a computerized pattern-maker. Students must design a garment, take their measurements, and use the information to take standard slopers and transform them into a pattern for their original design. They use Cochenille Design Studio's Garment Designer software, along with the reference and design manual. Students then construct the garment and finally, evaluate how well the final product matches the original design. (Hirose, 2009, p. 105). These are some examples of technology incorporated into the classroom and specifically a family consumer science curriculum using Bloom's taxonomy.

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The Inclusive Classroom: The Effects of Color on Learning and Behavior

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Color impacts student behavior within the physical learning environment. Due to the move toward including students with disabilities in the general education classroom, functional color applications are critical. This article reviews and analyzes existing literature and empirical evidence related to use of color in the classroom for students of all abilities. The three major areas reviewed were (1) the inclusive classroom for students with disabilities, (2) color theory, and (3) the physiological and psychological aspects of color. The results show that color is important in designing functional learning spaces. The results of this analysis may benefit educators, parents, and design professionals in designing beneficial learning environments for all students.

Color is a powerful design element that produces profound psychological and physiological reactions. Studies have shown a relationship between color preferences, emotions, and academic performance in students (Boyatzis & Varghese, 1993; Imhof, 2004; Karp & Karp, 2001; O'Connor, Sofo, Kendall, & Olson, 1990; Terwogt & Hoeksma, 2001; Wilkins, 2003). The inclusion of learners with disabilities in the general education classroom creates additional challenges for learning and behavior.

Federal law requires that children be educated in the least restrictive environment (LRE). The LRE is the requirement that special education students be educated with children without disabilities in the regular educational environment to the maximum extent appropriate to serve their needs. The Individuals with Disabilities Education Act (IDEA) of 2004 addresses the legal rights of students with disabilities.

Some students (such as those with Attention Deficit/Hyperactivity Disorder and Autism Spectrum Disorders) may be more sensitive to color in the learning environment due to heightened sensory responses and strong visual processing abilities (Freed & Parsons, 1997).

In the United States, every general education classroom is potentially inclusive. Teachers and school administrators need to understand the ways that color affects student behavior. A thoughtfully planned physical environment will enhance the psychological comfort of the most sensitive students by identifying and eliminating detrimental sensory impact. Careful planning during construction, selection of materials and finishes, and spatial organization can play a major role in behavior and learning in the classroom. The impact of the built environment on individuals with autism is a complex issue that has not been studied. Therefore, information must be gleaned from many areas to form conclusions. The purpose of this paper is to identify the impact of color on student behavior and achievement and make recommendations for appropriate use.

Method

An initial literature review was conducted using keywords to define interrelated categories. This method assisted in the identification of more specific keywords that related to

inclusion, color theory, and physiological and psychological reactions to color. The keywords were physical learning environment, color, learning disabilities, autism, attention deficit disorder, inclusion, integrated classroom, exceptional children, and special education.

The databases used were Pubmed, EBSCO Host, Google Scholar, Medline, PsycInfo, PsycArticles, Psychology and Behavioral Sciences Collection, Education Research Complete, Health Source, and Texas Tech University Libraries. Potential studies were identified from the review of articles and books. The studies were included if they were written in English and provided empirical validation on the impact of color in the classroom, the effects of color on mood and behavior, the effects of color on individuals with disabilities, or psychological and physiological responses to color.

Although a number of issues were discovered about color and students with disabilities, only pertinent findings relating to color application in classroom settings were included. Additionally, potential articles and books were identified by a systematic review of literature into the four categories of inclusion, color theory, physiological reactions to color, and psychological reactions to color. Finally, the reference lists for the included articles were inspected. Five books and eleven refereed articles were identified as meeting the criteria.

Literature Review

The Inclusive Classroom

Inclusion is a controversial concept in education whereby each student is integrated to the fullest extent possible in a general education classroom (Burke & Sutherland, 2004). The support services may be brought to the child instead of moving the child for services. Proponents of inclusion believe that the student should begin in general education classrooms and should only be removed if the necessary interventions cannot be provided in a regular classroom (Baker, Wang, & Walberg, 1995; Banerji & Dailey, 1995; Rea, McLaughlin, & Walther-Thomas, 2002). Those opposed believe that many students with disabilities are better served in special education classrooms or that inclusive classrooms provide no benefit (Fore, Hagan-Burke, Burke, Boon, & Smith, 2008; Holloway, 2001; McDonnell et al., 2003).

The Individuals with Disabilities Education Act (IDEA) enables millions of children with disabilities to receive special services designed to meet their unique needs. Children and youth between the ages of three and twenty-one may be eligible for services under thirteen different disability categories. The categories include autism, deaf-blindness, emotional disturbance, hearing impairment (including deafness), mental retardation, multiple disabilities, orthopedic impairment, other health impairment, specific learning disability, speech or language impairment, traumatic brain injury, or visual impairment (National Dissemination Center for Children with Disabilities, 2009).

In a July, 2007 report by the U.S. Department of Education, Office of Special Education Programs, 6,693,279 children with disabilities (ages 3-21) received special education under the Individuals with Disabilities Education Act. Full inclusion is not required by law and is not beneficial for all students with learning differences. A continuum of placements should be made available from full inclusion to self-contained special education classroom. According to the report (U.S. Department of Education, 2007), seventy-seven percent of students with disabilities spent at least forty percent of their day in general education classrooms. Over fifty-three percent spent at least eighty percent of the day in general education classrooms. The estimated 2.5 million children with Attention Deficit/Attention Deficit Hyperactivity Disorder (ADD/ADHD) are not served under IDEA and are not included in the statistics.

Great challenges may come with the inclusion of students with disabilities in general education classrooms. The physical learning environment must meet the needs of all students as the special and regular education systems merge. Color within the physical learning environment must be considered because of its profound effect on learning and behavior.

Color Perception and Theory

A brief explanation of color perception and theory are necessary to formulate a better understanding of the physiological and psychological responses to color. Color originates in sunlight and is perceived through subtractive color theory. The various wavelengths of light shine on an object and the surface absorbs or subtracts all the colored light rays except for the ones reflected from the object. This color is reflected received through the cells of retinal wall of the eye (Morton, 1995). Visible colors are defined by the cones of the eye. Humans have three kinds of cones: red, blue and green. These three wavelengths decipher millions of colors. Approximately 2-3 percent of women and some animals have at least four types of cones which increase color differentiation (Morton, 1995). These receptor cells absorb the hues and send a message to the brain where the colors are deciphered. Brain impulses are also sent to the major endocrine regulating glands that cause emotional and psychological responses (Nielson & Taylor, 2007). These receptors constitute two distinct pathways; a red-green system and a blue-yellow system (Banaschewski et al., 2006).

The Standard Color-Wheel theory (Morton, 1995) is based on a conventional color wheel. Red, yellow, and blue are primary colors meaning that they cannot be mixed by the combination of other colors. Secondary colors are formed by mixing the primary colors and tertiary colors emerge from mixing the secondary colors. These twelve colors compose the conventional color wheel. An unlimited number of colors may be obtained by mixing the twelve colors of the wheel along with black and white.

Color has three basic attributes: hue, value, and saturation (Morton, 1995). Hue is another word for color such as blue, red, or yellow. Value is the relative lightness or darkness of a color. A hue may be lightened by adding white or darkened by adding black. Intensity (also saturation or chroma) is the purity of a hue. A decrease in purity causes the hue to be muted or dull (Morton, 1995).

Color is also classified according to temperature. Half of the color wheel is classified as warm and the other half as cool. Colors associated with red and yellow are considered warm. Warm colors advance in a space. Cool colors are associated with blue and tend to recede. Visual temperature may also be affected by intensity (Nielson & Taylor, 2007). Overall, preschool and elementary age children prefer warm colors, and secondary students prefer cool colors (Engelbrecht, 2003).

Color perception and temperature are also influenced by lighting. Placing a blue painting under a bluish light (such as a cool fluorescent) will heighten the blueness of the painting. However, a red painting under a blue light will become dull and grayish because no red color waves are being made by the light. A study by Styne (1990) showed that a space painted with cool colors under cool fluorescent lighting resulted in spaces that seemed larger, quieter, and cooler. A space with warm colors under warm incandescent lighting resulted in a more active space that seemed smaller, warmer, and louder. Fast food restaurants use warm bright colors to stimulate appetite and the perception of noise. As a result, sales increase due to the fast turnover. Such information provides useful insight when designing environments beneficial for learning.

A study conducted in Germany (Banaschewski et al., 2006) determined that students with ADHD experienced distorted color discrimination abilities. This distortion occurred along the blue-yellow system. No distortion was found involving the red-green pathways. The blue-yellow color vision problems were also found with Tourette's syndrome, Parkinson's disease, Huntington's disease, cocaine-withdrawal, normal aging, and exposure to environmental pollutants (as cited in Banaschewski et al., 2006). Based on the review of literature, this is the first and only study of color perception in students with ADHD. The implications of these findings are unknown through empirical evidence; however, conclusions have been drawn on the physiological and psychological reactions to color in the general population. This color vision impairment warrants further investigation in individuals with color distortion to determine if the reactions are the same or different.

Physiological and Psychological Responses to Color

Responses to color are both scientific (physiological) and emotional (psychological). Studies (Engelbrecht, 2003; Morton, 1998) related to physiological effects have shown changes in blood pressure, eye strain, and brain development. For example, exposure to red causes the heart to beat faster, an increase in blood pressure, and a heightened sense of smell. In contrast, blue causes a slower pulse rate, lower body temperature, and reduced appetite (Engelbrecht, 2003).

Psychological responses to color include changes in mood and attention (Engelbrecht 2003; Shabha, 2006). The brain releases a hormone which affects moods, mental clarity, and energy level when color is transmitted through the eyes (Engelbrecht, 2003). For example, pink may suppress aggressive behavior in prisoners (Walker, 1991). Interestingly, color's impact is not limited to visual aspects since color wavelengths are absorbed by the skin (Torice & Logrippo, 1989). Wohlforth and Sam (1982) also supported this claim in their study. Findings showed that changes in the color of the environment resulted in a drop in blood pressure and reduction in aggressive behavior in blind children as well as sighted.

Some color responses are temporary and others may last for a long period of time. Many reactions are immediate (Morton, 1998). A number of studies have explored the impact of color in the classroom (Engelbrecht, 2003; Grangaard, 1995; Imhof, 2004; O'Connor et al., 1990; Wilkins, 2003). Findings are inconsistent in determining the optimal color choices in learning environments. Therefore, the following information serves to provide functional guidelines and explain the importance of color in the classroom.

The research conducted by Torice and Logrippo (1989) has shown that active children prefer cool colors and passive children are more comfortable surrounded by warm colors. Morton, 1995 contend that the purity and contrast with other colors is more important than color temperature. In other words, a strong green may stimulate an individual as much as a strong red (Morton, 1998).

Additionally, quantity of color should be considered in the design of the physical learning environment. Large amounts of color overstimulate individuals no matter the color temperature or preference. Verghese (2001) discusses the process of visual search and attention in regard to signal detection theory. This theory states that the human mind continuously strives to organize visual information. Too much color, motion, or pattern functions as distracters making visual search more difficult. A stressful learning environment will result from excessive use of color. Table 1 outlines findings, issues, and associations related to specific colors.

Table 1
Categories, Issues, and Findings Related to Color

Category	Findings	Source
Red	Concerned with the base of the spine and motor skills	*Torrice & Logrippo, 1989*
	Raises blood pressure	*Morton, 1998*
	Increases respiration	
	Heart beats faster	*Engelbrecht, 2003*
	Heightened sense of smell	
	Associated with excitement and happiness	*Boyatzis & Varghese, 1993*
	Positive reaction - girls more positive than boys	
	High preference for 7-year-olds	*Terwogt, & Hoeksma 2001*
	Associated with anger, pain, happiness, and love in 4th grade students	*Karp & Karp, 2001*
Blue	Favorite color for 7 and 11-year-olds	*Terwogt, & Hoeksma 2001*
	Correlates to eyes, ears, and nose – seeing, hearing, smelling	*Torrice & Logrippo, 1989*
	Sight and hearing impaired children favor prefer blue	*Torrice & Logrippo, 1989*
	Calming effect on heart rate and respiratory system	*Engelbrecht, 2003*
	Lower body temperature	*Torrice & Logrippo, 1989*
	Reduced appetite	*Morton, 1998*
		Walker, 1991
		Morton, 1998
	Positive reaction - girls more positive than boys	*Boyatzis & Varghese, 1993*
	Associated with sadness in 4th grade students.	*Karp & Karp, 2001*
Yellow	Responds to chest, heart, lungs	*Torrice & Logrippo, 1989*
	Children with asthma and other breathing problems react favorably to yellow.	
	High preference for 7-year-olds	*Terwogt, & Hoeksma, 2001*
	Associated with honesty in 4th grade students.	*Karp & Karp, 2001*
	Most luminous and visible of all colors. Large quantities may irritate the eye	*Morton, 1998*
Green	Relates to the throat and vocal cords.	*Torrice & Logrippo, 1989*
	Affects developing speech skills.	
	The most restful for the eye.	
	Associated with life in 4th grade females.	*Karp & Karp, 2001*
Orange	Corresponds to circulation and nervous systems.	*Torrice & Logrippo, 1989*
	Tremendous tonic effect	

Category	Findings	Source
Violet	Corresponds to the top of the head and cerebral activity. Supports non-verbal activity.	*Torrice & Logrippo, 1989*
	Symbolizes high levels of wisdom and authority. In children: a mind deep in thought, concerned, or afraid.	
Pink	Positive reaction - females more positive than males	*Boyatzis & Varghese, 1993*
	Tranquilizing effect	*Morton, 1998*
	Reduces aggression in prisoners.	
Brown	Negative emotions - males more positive than females.	*Boyatzis & Varghese, 1993*
	Associated with strength in 4th grade males.	*Karp & Karp, 2001*
Black	Negative emotions - Males more positive than females.	*Boyatzis & Varghese, 1993*
	Associated with school and fear in 4th grade males.	*Karp & Karp, 2001*
Gray	Negative emotions - males more positive than females.	*Boyatzis & Varghese, 1993*
Cool Colors	Recede	*Nielson & Taylor, 2007*
	Preferred by active children	*Torrice & Logrippo, 1989*
	Recommended for secondary classrooms	*Engelbrecht, 2003*
Warm Colors	Advance	*Nielson & Taylor, 2007*
	Preferred by passive children	*Torrice & Logrippo, 1989*
	Preferred by preschool and elementary students	*Engelbrecht, 2003*

Studies by Shabha (2006) and Gaines (2008) explored the impact of visual environmental stimuli for students in a special needs and general education schools. Teachers were surveyed and determined that visual triggers (including lighting and color) in classrooms have an adverse effect on the behavior of students with disabilities. Some of the behaviors observed included staring at light sources, repetitive blinking, moving fingers in front of the eyes, and hand flapping. The outcome of these behaviors may lead to poor concentration, communication, and social interaction.

Grangaard (1995) explored the effects of color and light on learning for 6-year old students. Off-task behaviors and blood pressure were measured in two environmental conditions. The first classroom had white walls and cool-white fluorescent lights. A second classroom was modified with light blue walls and full-spectrum lights. Findings showed that off-task behaviors decreased by 22 percent in the modified room. Additionally, blood pressure readings showed a nine percent reduction in the second classroom.

There is evidence that color may impact learning outcomes of students with ADD/ADHD and ASD (Imhof, 2004; Zentall & Dwyer, 1989). Findings in the area of color preferences for learners with ASD and ADD/ADHD are varied. Some children with ASD and ADD/ADHD are attracted to bright colors, while others are overwhelmed by the stimulation. Imhof (2004), Zentall & Dwyer (1989), and Kennedy (2005) contend that color stimulation in the learning environment improves attention and motor processes, resulting in better academic performance. A study conducted by the United States Navy, showed a 28 percent drop in accidents with the introduction of color (Engelbrecht, 2003). However, white and off-white business environments resulted in a 25 percent drop in human efficiency. Monotone environments create restlessness, excessive emotional response, difficulty in concentration, and irritation (Engelbrecht, 2003).

Clay (2004), Stokes (2003), and Myler, Fantacone, and Merritt (2003) found that a subdued color scheme in warm neutral colors is necessary to prevent overstimulation. They encourage low contrast in wall and flooring. Clay (2004) found that a subdued and neutral color scheme is necessary as most children with ASD and ADD/ADHD have negative responses to primary colors. As a compromise, Engelbrecht (2003) suggests that color can relieve eyestrain by painting the wall students focus on when looking up from their work a medium hue. According to Engelbrecht (2003), the other walls should be a warm beige or tan.

A study at the University of Texas in Austin (Kwallek, Lewis, Lin-Hsiao, & Woodson, 1996) was conducted using 675 college students. Test offices were painted 9 colors (four walls and the door), including red, white, green, orange, yellow, blue, beige, gray, and purple. Students were evaluated on task performance, mood, and color preference. Findings showed gender differences in color preferences. Men preferred white, green, blue, and gray work environments and did not like yellow, orange, and purple spaces. The women preferred green, red, and beige offices and did not like the gray and orange spaces. Overall, white, blue and green offices received the highest scores. Purple and orange work environments were the least preferred.

Gender differences regarding mood in different colored environments were also observed. More depression, confusion, and anger were experienced by females in spaces with low-saturated colors of white, gray, and beige. Males experienced the negative emotions in high-saturated environments of green, blue, purple, red, yellow, and orange (Kwallek, et al., 1996). Most participants stated they prefer to work in beige or white offices. However, more errors occurred on task performance in the white office than in blue and red offices.

Additionally, studies have shown that personal applications of color can improve academic performance (Imhof, 2004; O'Connor et al., 1990; Wilkins, 2003). A study by Imhof (2004) found that students with ADHD showed improved control of attention and motor processes when using colored paper. A control group of students without ADHD did not exhibit a significant improvement when using colored paper.

The uses of colored lenses and colored overlays have shown a dramatic improvement in reading for those with reading disabilities (O'Connor et al., 1990; Wilkins, 1996). Scientific foundation for the improvement is poorly understood. Distortions in spatial perception may be manifested in letters that appear to move on the page. The use of colored lenses showed

improvement in reading and a reduction in headaches. Table 2 summarizes physiological and psychological reactions to color.

Table 2
Categories, Issues, and Findings Related to Physiological and Psychological Reactions to Color

Category	Findings	Source
Physiological Differences	Color discrimination distorted along blue-yellow system with ADHD	*Banaschewsk et al., 2006*
Physiological Reactions	Relieves eye fatigue	*Engelbrecht, 2003*
	Changes in blood pressure and brain development	
	Eyes and skin detect color rays	*Morton, 1998*
	Bright, warm colors stimulate autonomic nervous system	
	Soft, cool colors retard autonomic nervous system	
Psychological Reactions	Color can have an adverse affect on the behavior of students with ASD.	*Shabha, 2006* *Gaines, 2008*
	Monotone environments create restlessness	
	Warm, neutral colors prevent overstimulation	*Engelbrecht, 2003* *Clay, 2004*
	Blind and sighted children react to color	*Myler et al., 2003*
	Color preferences change with age	*Engelbrecht, 2003* *Terwogt & Hoeksma, 2001*
Mood	Subjects unable to screen environmental stimuli were more angry in an office painted white and depressed in the office painted red	*Morton, 1998*
Attention	Improvement with colored paper	*Imhof, 2004*
	Use of color improves attention	*Zentall & Dwyer, 1989*
	Workers in offices with saturated colors reported more vigor – blue and green highest scores	*Engelbrecht, 2003* *Morton, 1998*
	Easily distracted subjects scored lower in proofreading in a red office	
	Subjects not easily distracted scored lower in a blue office	
Productivity	Improved academic performance	*Engelbrecht, 2003*
	White and off-white environments less efficient	*Engelbrecht, 2003* *Morton, 1998*

Category	Findings	Source
Accuracy	Improved academic performance	*Engelbrecht, 2003*
	Improvement in reading with colored lenses and overlays	*O'Connor, 1990* *Imhof, 2004* *Wilkins, 1996*
	Drop in accidents with introduction of color	*Englelbrecht, 2003*

Conclusion

The present analysis is perhaps the first to investigate the appropriate use of color for inclusive classroom design. Color has the ability to impact student attention, behavior, and achievement. The proper application of color in the classroom has become more important due to the move toward inclusion in the public schools of the United States. New demands are placed on academic spaces because of increase in the prevalence of students with learning disabilities. Many students with disabilities are more sensitive to color within the classroom.

When choosing colors in educational environments, the functional aspects rather than aesthetics of color should be emphasized. Over-stimulation through color creates sensory overload. In contrast, colorless interior spaces can be stressful and nonproductive. In other words, an under-stimulating environment may be as harmful as one that is over-stimulating. In addition, empirical studies support the existence of individual and gender differences in choosing appropriate colors for learning environments. Initially, the studies appear to be in opposition to one another with regard to the proper use of color in learning environments.

However, when the empirical evidence is reviewed as a whole, it reveals that in order to facilitate learning, balance is needed in color applications for classrooms. Through the analysis of literature, six recommendations can be made for incorporating color in learning spaces. These recommendations apply to every classroom, whether or not students with disabilities are present. (1)Teachers may have little control over wall, floor, and ceiling colors in the classroom; however, a warm neutral color scheme of tan or sand would be a desirable foundation for classroom design and should be applied to those surfaces. (2) The wall that students focus on when looking up from their work should be a medium hue in the same color range. (3) Strong or primary colors should be avoided; however, soft colors such as green or blue may be used in other areas within the classroom. (4) Discovering a child's color preferences and using those colors may be beneficial. (5) Personal applications of color may be easily added through study carrels, colored reading lenses, and colored paper. (6) Using different colored tape for boundaries or to serve as a means to locate charts (e.g. a teacher might direct students to look at the green poster) will benefit students with or without disabilities.

A walk through the halls of many United States public schools will reveal that signal detection theory is being ignored. Teachers need to be aware that color within the classroom has an effect on student mood, behavior, and performance. The impact of color on students with and without disabilities warrants further investigation.

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Designing Newsletters to Recruit Family and Consumer Sciences Education Majors, Our Future North Carolina FCS Teachers

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Newsletters to inform students about family and consumer sciences (FCS) education and teaching were developed by a teacher educator at a Southern regional university. The newsletters provided general information about the university and department, classes FCS majors would complete, and future job prospects. The newsletters also featured some of the current students and recent graduates who were new teachers. Newsletters were distributed to high school FCS teachers and students to provide information about the FCS education major. The newsletters were well received by teachers as evidenced by their positive feedback.

The family and consumer sciences (FCS) teacher shortage has been clearly documented, both in North Carolina and across the country (AAFFCS, 1999; Bartley & Sneed, 2004; Bull, Uerz, & Yoakum, 2000; Lee, 1998; Miller & Meszaros, 1996; Mimbs, 2000; Pickard, 2005; Tripp, 2006; Werhan & Way, 2006). Ironically, high school FCS enrollments in North Carolina continue to increase, and this increased enrollment has created a demand for even more FCS teachers (J. Meeks, North Carolina Department of Public Instruction, personal communication, September 10, 2010). Unfortunately, the numbers of students who major in FCS education and plan to teach has declined in recent years (Bartley & Sneed, 2004; Scruggs, Leslie, Scott, & Weber, 2000). In North Carolina, only about 20-30 FCS education majors graduate annually (J. Meeks, North Carolina Department of Public Instruction, personal communication, September 10, 2010)--numbers which will never provide the number predicted to be needed. Some of the current vacancies are being filled by substitute teachers or lateral entry teachers. Sometimes these arrangements work out satisfactorily, but more often than not, these educators leave the classroom as they are unprepared for the challenges of teaching. The result may be that some secondary FCS programs in North Carolina will be closed if qualified FCS teachers are not located (J. Meeks, North Carolina Department of Public Instruction, personal communication, September 10, 2010).

Meeting the FCS teacher shortage is critical because middle school and high school FCS programs provide some of the earliest and best opportunities for students to learn about the importance of families, child development and parenting education, and establishing healthy lifestyles. Because the current shortage of FCS teachers threatens the future of secondary FCS programs, there is a definite need to study this critical problem and recruit students into this area. Previous studies conducted by this author have indicated that young people are generally not motivated toward teaching family and consumer sciences for a number of reasons (Lee, 1998; Lee, 1999). Surprisingly, pay is not usually one of these; instead students generally report that classroom discipline problems deter them most from considering a career in family and consumer sciences teaching. In addition, some perceive that teaching family and consumer sciences involves teaching only subjects such as cooking and sewing. While this appeals to a few, it deters many who share that they want a more challenging career. Also, most high school

students are not aware of the current shortage of secondary family and consumer sciences teachers, and therefore, the excellent employment opportunities (Lee, 1999).

In addition to current and accurate information, a crucial factor in recruiting students is recognizing their need for belonging (McGlynn, 2003). A welcoming approach and cultivation of a sense of community are extremely important when inviting students to consider majoring in family and consumer sciences education. In a past effort, recruitment brochures were developed to utilize at large gatherings such as career fairs or college family day. These brochures effectively informed large groups of students about an FCS education major and FCS teaching. However, a more personal and welcoming tool is needed for individual recruitment efforts.

Considering the ongoing FCS teacher shortage, it is clear that we need to recruit interested young people to consider an FCS teaching career. We need to provide them with accurate, relevant information about family and consumer sciences education, as well as appeal to their need for belonging and desire for community. One effective, versatile, and cost-effective method of providing such information in this way is through a series of newsletters (Shackelford & Griffis, 2006; Shepherd & Roker, 2005). These can be more personal than brochures and can hopefully lead to further contacts and communication.

The purpose of this project was to develop and distribute a series of newsletters to inform targeted high school students of the benefits of majoring in family and consumer sciences education. Hopefully these students might ultimately become family and consumer sciences teachers. Specific objectives were to:

- Develop a spring and fall newsletter for high school students who were possibly interested in becoming family and consumer sciences teachers. The newsletters would inform students about the family and consumer sciences education major, as well as the career of family and consumer sciences teaching. They would also contain appropriate, helpful, and interesting information about the department, university, and college life in general.
- Send the newsletters to selected family and consumer sciences teachers in the western half of the state to distribute to students who might be interested in becoming family and consumer sciences teachers.
- If possible, secure feedback and contact information which would enable additional recruitment efforts to be employed (i.e., correspondence with students, visit to schools, etc).

Following a review of selected literature related to effective development and use of newsletters (Jensen, 2007; Mathieu, 2007; Meharg, 2009; Shackelford & Griffis, 2006; Shepherd & Roker, 2005; Stansfield, 2007), two newsletters targeting high school students were planned. A fall newsletter was sent to schools in October while a spring newsletter was mailed in March. The purpose of both was to inform students about FCS education as a major at Appalachian State University and FCS teaching as a career. The fall newsletter provided general information about Appalachian State University, followed by information about the Department of Family and Consumer Sciences. It also included information on the kinds of classes FCS classes students would complete, information related to job prospects, and featured some of the current students and recent graduates. The spring newsletter offered further information about classes in the major, as well as extra-curricular and leadership opportunities. It also contained pictures and information about current students in the program. Both newsletters were funded by the

Katherine B. Lyons Family and Consumer Sciences Endowment. They were developed using the Microsoft Publisher software and printed through the Appalachian State University Technology Department's graphic arts and imaging program at a cost of .75 per copy.

A packet containing a cover letter and five newsletters was sent to FCS departments in 85 schools in the northwest and western regions of the state. The cover letter informed FCS teachers about the newsletters and requested that they distribute them to students who might be interested in becoming FCS teachers, specifically high school juniors and seniors who were planning to attend college and perhaps major in FCS education. Teachers were also requested to send students' contact information to the researcher if possible; however, only a few names were provided to the researcher.

The feedback from secondary teachers and students has been very positive. At least two incoming freshmen students reviewed the newsletters last year in one of their FCS classes and initiated personal communication with the FCS teacher educator at Appalachian State University. Those two individuals are now in the FCS Education program at Appalachian State University and are preparing to become FCS teachers in North Carolina. In other cases, teachers wrote to say they had posted the newsletters in their classrooms and made announcements about them to their students. Further results from the newsletters will be difficult to assess, but hopefully they have initiated interest and inquiry into family and consumer teaching. On a personal note, the enrollment of students majoring in FCS Education at Appalachian State University has doubled in the past year. While this certainly cannot be attributed solely to these newsletters, this project could indeed have contributed to the ongoing efforts to promote FCS teaching as a desirable career with ample opportunities for employment.

The current newsletters and process have been replicated by other teacher educators to recruit potential students to FCS teaching. The process of seeking feedback from the teachers and students will hopefully prompt increased dialogue among FCS teacher educators and FCS secondary teachers, as well as initiate further appropriate relationships with potential majors.

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