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Abstract

The purpose of this Dissertation in Practice was to determine if differences in risk tolerance among men and women in post-secondary Science, Technology, Engineering, and Mathematics (STEM) faculty positions affected the retention and success of women in those positions. The aim of the study was to determine whether women who pursue STEM faculty positions have different perceptions of their professional settings and risks to success than men who pursue the same career paths in order to determine if their tolerance of those risks differed from men. Using the qualitative methodology of phenomenology, the researcher conducted telephone interviews with faculty members in STEM positions at universities in the United States to ascertain their perspectives on their career path. Interviewees included both men and women from nascent faculty to retired. Findings revealed a wide variety of perspectives and approaches to the career path of men and women who pursue academic and research careers in STEM disciplines within the Academy, while revealing a nearly unanimous reason for choosing the path in the first place: curiosity. The disparity of outlooks suggested there would be no simple, one-size-fits-all, solution to the problem of unequal distribution of men and women in STEM faculty and the resultant distribution of university senior administration they might rise to. The dissertation offered a suggested course of action to enable the post-secondary academic and research enterprise at her institution, and by replication in similar institutions in the U. S., to become more flexible in approaches toward recruitment, retention, and promotion of all faculty members in order to ensure a vibrant climate through which to educate and inspire its future leaders in thought, policy, and innovation.

Keywords: Education, faculty, post-secondary, research, STEM.
Dedication

This dissertation is dedicated to Florence Hall Busby, a woman ahead of her time.
Acknowledgements

So many people have contributed to the success of this dissertation along the way, it is difficult to properly acknowledge them all. The two Hall Sisters who initially enabled me to complete my undergraduate degree while in my 40s certainly merit the first mention. Were it not for Florence Hall Busby and Alice Hall Beck – two women who entered the professional health care workforce during World War II – I would never have undertaken this study. Their encouragement and monetary support and their modeling of how to be fierce in pursuit of one’s passion were equally valuable and remain so.

Colleagues and fellow students along the way who offered advice, commiseration, and encouragement, and demanded accountability, include (in alphabetical order, because each is as significant as the next) Denise Barnes, Andrea Boldon, Kelvin Chu, Lois-ellin Datta, Patrick Hart, Jay Hicks, Paul Hill, Matthew Knope, Doreen Koizumi, Jo-Ann Leong, Rosette Obedoza, Rebecca Ostertag, Donald Price, Elizabeth Stacy, Ronnie Vesperas, and Lisa Zumpft. Lisa in particular was highly instrumental in launching my pursuit of graduate degrees, and I thank her for her advice to keep amassing them.

My family inspires me to pursue academics. My husband, Henry, has been on this path with me the whole time and has been steadfast in his faith in me as well as his refusal to even entertain the thought of my dropping out at any point along the way. Completion of the baccalaureate was done in order to model the importance of post-secondary education for our children, James, Melanie, and Stacy. Completion of the Masters and this Doctorate were accomplished largely because our grandchildren were watching. Demonstrating to Ciani, Kaden, Conan, Conrad, Kaitlyn, Ciri, and Connor that
we value education and we finish what we start is going to be an invaluable lesson as they continue to mature.

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CHAPTER ONE: INTRODUCTION

Introduction and Background

The United States of America (U. S.) has long been thought of as a superpower in terms of military and economic might. This has been the case for our nation’s ability to be innovative in industry, business, academic, and health scenarios. Continuing to be at the forefront of research and development innovation is critical to our national standing in the global economy. It is incumbent on educators in all levels to ensure that citizens who have good ideas and the inherent intelligence to pursue them have the opportunities to do so – as well as the role models who will serve to inspire and encourage them. Teachers in K-12 schools model behaviors that our students are expected to embody. When our youth progress to post-secondary education, their faculty members continue this as they engage in professional preparation and development activities while providing our students with engaging, relevant, and rigorous academic material and research opportunities.

This researcher believes that who our university students see at the front of their classrooms impacts their ability to envision themselves in similar leadership roles. It is therefore likely to be valuable for our post-secondary faculty to accurately represent our population in demographic terms: not only with regard to ethnic backgrounds, but also those of gender and even (to the extent possible) to such aspects as disabilities and sexual orientation.

The post-secondary faculty in the U. S., particularly in science, technology, engineering, and mathematics (STEM) disciplines, is skewed toward men (National Science Board, 2018), leaving the impression that women either do not, cannot, or
perhaps should not pursue careers in these fields. The latest data available from the National Science Board’s Science and Engineering Indicators (National Science Board, 2018) revealed that while women make up 50% of the college-educated workforce, they comprise only 29% of STEM disciplines in the aggregate. When examining these statistics by discipline, one sees that in Engineering the representation by women is at 15%; in Physical Sciences it is at 28%; Social Sciences and Life Sciences reveal the highest levels of representation at 60% and 48% respectively; while Computer and Mathematical Sciences considered together account for 26%.

Figure 1.

Representation by Women in the STEM Workforce (National Science Board, 2018)

This is a great disservice to girls and young women. In this study, the writer examined trends in faculty demographic composition at universities in the U. S. – and in particular at the one in which she has served her academic career for the past 20 years – with a specific eye toward learning why women in STEM disciplines seem to leave them at higher rates than men (Xu, 2008). Although women are making strides in their
representation in STEM disciplines (National Science Board, 2018), their departures are still at a higher rate than those of men in the same fields (Xu, 2008). The researcher theorized that if women who became faculty in some STEM disciplines did so with the knowledge they were entering as a minority, and as such likely faced certain challenges that men did not, they had a higher risk tolerance than the men with whom they worked.

With the rise in globalization (Friedman, 2005), it is vital that our country recruit and retain as many of our citizenry to the fields where innovation is taking place. Toward that end, ensuring women in those fields feel empowered to pursue them will be critical to our nation’s continuing scientific, technological, and economic innovation.

**Statement of the Problem**

Studies reveal that women’s representation in STEM faculty positions is at a lower rate than their percentages of the general population (National Science Board, 2018). While women have increased their levels of representation over the last few decades in particular, their numbers are still much lower than their percentage of the overall population would suggest (National Science Board, 2018). This is important for the U. S. because the nation’s vigorous innovation depends on a robust pipeline of well-educated and highly motivated critical thinkers who will continue to contribute to the economic engine that drives innovation (National Science Board, 2015).

This Dissertation in Practice focused on institutions in the U. S. The researcher’s entire academic career has focused on building research infrastructure and improving participation by under-represented groups in both post-secondary education and in research for the past 20 years. As such, she has been part of several federally funded, national initiatives that aim to bolster these endeavors in American post-secondary
institutions. Findings of this study provide a basis for studies at similarly structured universities in the U. S., and can also form the basis for similar studies in other countries within their post-secondary institutions.

**Purpose of the Study**

The purpose of this qualitative Dissertation in Practice was to determine if differences in risk tolerance between men and women in STEM faculty positions affected the retention and success of women in those positions, and how to better ensure they would persist in their career paths in academe.

Universities have engaged in a variety of activities designed to increase recruitment and retention of women to STEM disciplines, especially since the 1990s (National Science Board, 2015). Those efforts have had some limited success, but women still tend to leave their positions in STEM disciplines at universities at a higher rate than men do. Xu (2008) indicated women’s levels of commitment to their fields of study were as firm as those of men in the same fields, yet they still left their positions more readily than men. That study further suggested the cultural considerations women encountered could be a driving force behind their tendencies to leave positions more readily. The author of this Dissertation in Practice theorized that women who enter STEM faculty positions traditionally dominated by men exhibited a higher tolerance for risk simply by entering a profession in which they were in a notable minority, and which was known to present its members with a very inflexible set of policies and expectations (Valentino, Moller, Stearns, & Mickelson, 2015).
Research Questions

The questions this Dissertation in Practice sought to answer were: Is there a difference in women and men’s risk tolerance that leads them to stay in or leave from their positions more readily? How do differences between men and women in STEM faculty positions affect the retention and success of women in those positions?

Aim of the Study

The aim of this Dissertation in Practice was to determine whether women who pursued STEM faculty positions have different tolerances of the risks of their professional settings than men who took the same career paths. Demonstrating such a difference in how women and men approach their careers as STEM faculty would result in tailored recruiting and/or retention strategies and yield a more equitable level of representation of women in STEM fields alongside men.

Methodology

The author conducted this study by first examining the current literature on gender-related questions about women entering and persisting in academic professions in STEM disciplines. In this manner, the researcher hoped to gain some understanding of why women left their faculty positions at a higher rate than men did, and to account for differences in trends over time in the Academy. The researcher conducted interviews with self-selected post-secondary STEM faculty members, using a phenomenological approach to discern whether gender-specific trends exist as to why women left their positions at higher rates than men. Phenomenology focuses on the experiences of people in a specific phenomenon (Creswell, 2014) – in this case, STEM faculty members in post-secondary educational institutions in the U. S. The researcher employed direct
interviews to determine what if any attitudinal frames of reference women brought to bear differed significantly from those of men in the same or similar roles. In this manner, the author guarded against imposing the question on the data, instead of allowing the data to inform the resolution of the question.

There was a plethora of data available, due largely to the fact that the National Science Foundation has a long-standing program targeting recruitment and retention, and eventual progression into administrative positions, of women in STEM faculty positions at post-secondary educational institutions (NSF ADVANCE, 2020). This author made use of the many published research studies, that included surveys and interviews of university women in STEM fields.

This writer is a member of the NSF ADVANCE community and a former member of the Established Program to Stimulate Competitive Research (EPSCoR) (NSF EPSCoR, 2020). The ADVANCE program seeks to recruit, retain, and promote women within the Academy in greater numbers (NSF ADVANCE, 2020). The EPSCoR program seeks to improve competitiveness on the jurisdictional (state or territory) level in places historically not well represented in the federal research and development (R&D) funding in the U. S. overall (NSF EPSCoR, 2020).

Both of these communities have a broad base of participants who include members of under-represented groups such as but not necessarily limited to women in STEM. This writer had planned to work with NSF Program Officers whose programs have published the most relevant findings about women STEM faculty’s higher rate of attrition to secure permission to solicit participation in interviews of members of their funded projects. She discussed this idea with the national Office Head of the EPSCoR
program, who was interested in its possible implications and expressed a willingness to allow circulation of such an invitation to participate to that community (D. Barnes, personal communication, May 23, 2017). Due to delays in implementing her interviews, the researcher found that personnel changes at NSF resulted in necessary permissions to use their listservs no longer being available. She therefore made arrangements to use alternate listservs: project administrators’ listservs for the EPSCoR and ADVANCE projects, and the faculty listserv at her home institution, University of Hawai‘i at Hilo. After interviews were conducted, responses were coded and analyzed, and reported in the aggregate and anonymized to ensure confidentiality of the participants.

**Definition of Relevant Terms**

The following terms were used operationally within this study:

*Academy:* A term used to refer to post-secondary institutions in general.

*Faculty:* Personnel at a university or college who provide instruction and/or conduct other scholarly works such as research.

*Risk tolerance:* A term based in economics, this describes the willingness of an individual to be exposed to loss in return for potential gain, when pursuing a goal or objective.

*STEM:* Science, Technology, Engineering, and Mathematics.

*Tenure:* In an academic setting, this refers to the conveyance of a permanent assignment of a position that can be withdrawn only under very restrictive conditions.

While the concept of risk tolerance is one that is embedded in economics, it applies to any endeavor that carries with it a certain possibility of failure. Particularly in academic fields, the achievement of tenure offers a safe haven for those who would not
ordinarily launch a new venture without knowing its chances of success. Therefore, for a person in the academic setting, perhaps pursuing both teaching and research, knowing their risk tolerance would be a good predictor for whether that person might be more or less inclined to leave a faculty position.

**Delimitations and Limitations**

Use of National Science Foundation populations, while offering a national scope for respondents, is still delimiting in its nature but the wealth of data available makes this delimitation acceptable. The population under examination was that of successful proposers to that agency, a small sub-set of the national population but one that carries with it a willingness to engage in professional competition that can be very keen. Replication of this study would be difficult but possible as long as the continuously changing nature of the population under scrutiny were accounted for.

Limitations included the fact that the background data had already been gathered under auspices of two established programs within a single federal science agency, the National Science Foundation. Because each of those programs had its own set of criteria for participation and expectations of interventions implemented, there was a chance that this investigation would experience certain gaps in its findings. For instance, the definition of STEM from the NSF point of view is one that is limited: it does not include health-care disciplines or career paths (National Science Board, 2018).

EPSCoR funds are limited to states and territories (jurisdictions) in the U. S. “if their most recent 3-year level of NSF research support is equal to or less than 0.75% of the total NSF Research and Related Activities (R&RA) budget” (NSF EPSCoR, 2020). ADVANCE targets strictly women STEM faculty (NSF ADVANCE, 2020). EPSCoR
seeks to improve research focus areas that are on the cusp of becoming nationally competitive in the various jurisdictions it serves. Likewise, ADVANCE data, being highly focused on women in STEM, may miss certain aspects of career pursuits that men as opposed to women might seek to accomplish.

The author of this Dissertation in Practice is a member of the academic community being examined through this study, and therefore had to be diligent in not applying personal views on that population while devising questions and analyzing their answers. The author recognized that her personal bias might have therefore come into play during the drafting of interview questions and subsequent analysis of responses and was diligent in attempting not to allow that to occur.

The Role of Leadership in this Study

The issue of gender representation in STEM disciplines is one that is well addressed through the adaptive leadership model (Adaptive Leadership, 2017). This issue has been under study for decades, and many approaches have been suggested to ameliorate the misrepresentation of women in STEM fields. While data have been collected over many years, the people in the fields that data deals with have been continually changing. Therefore, it was imperative to continue to collect and analyze data as the study continued – the practice of continual and repeated diagnosis, as it were (Heifetz, Grashow, and Linsky, 2009). Applying an adaptive leadership model allowed for the researcher to attribute value to the subjects under consideration, as well as to engage in the iterative process that kept progress fresh – challenging the status quo as it got moved forward.
Over time, many styles of leadership have been brought to bear on the issue of women STEM faculty leaving their positions at a higher rate than men. Universities have a variety of governance styles and business models – publicly funded or private, unionized or not, for profit or non-profit – and as such, a variety of leadership or authority models that are in effect.

This writer found that the adaptive model proved a useful one through which to affect positive change in women’s rates of departure. Likewise, the issue of whether women were more willing to take the leap away from their positions into the unknown was one by which an adaptive approach would be informed. Such a bottoms-up approach to leadership was well suited to examining reasons for participants to enter or depart a professional path.

**Significance of the Study**

The makeup of faculty in post-secondary institutions in the U. S. has long been primarily comprised of men. This resulted, some believe, in a culture in those institutions unwelcoming to women. That in turn resulted in fewer women pursuing STEM academic positions, and in the women who did choose them to leave at higher rates than their male counterparts.

This study examined existing data to compile reasons women leave their faculty positions at this higher rate than men. The proposer recruited a pool of interviewees to explore if and how tolerance for risk on departure was a deciding factor in women choosing to leave or men choosing to stay. This information had the potential to result in changes to policy, especially those dealing with tenure and promotion, at STEM departments in universities where the interviews were conducted, which might in turn
have resulted in broader policy changes across university cultures. University policies (or lack thereof) about family leave, tenure clock pause/stoppage, burdens of committee membership, among others have often been cited as impediments to broader representation by women (Marschke, 2007). These policy changes had the potential to encourage more women to stay in their faculty roles, thereby adding to their representation in their fields – which in turn could encourage more women to enter those fields in the future.

Summary

The U. S.’s position of pre-eminence on the global stage regarding scientific and technical innovation is slipping (Friedman, 2005). The training ground for innovators in STEM fields is the universities of this country. Those universities need to have a faculty that is representative of our population, including the demographic of gender. In order to determine why women leave their faculty positions at higher rates than men, this study examined existing data concerning trends and conducted interviews of self-selected participants to determine whether risk tolerance played a significant role in their decisions to stay or go.
CHAPTER TWO: LITERATURE REVIEW

Introduction

The following literature review provided a background of the research, development, and innovation in the STEM enterprise of the U. S. It then presented findings about gender differences in STEM faculty and research positions. This was followed by a review of the literature about risk tolerance and/or aversion as pertains to genders, and leadership in academe. This literature review provided the underpinning to examine the question of whether a basic difference in risk tolerance between men and women contributes to women’s higher rate of attrition from STEM faculty positions in post-secondary educational institutions.

Understanding the Academic STEM Enterprise in the U. S.

In order to understand why one demographic of academic faculty persists at different rates than another, it was first necessary to understand the scientific enterprise of the U. S. as a whole. Toward that end, the author delved into the history of science and engineering research and innovation in this country, concentrating on the relationship the federal government has long had with the country’s STEM enterprise.

During World War II, the U. S. established the Office of Scientific Research and Development, with Dr. Vannevar Bush as its Director. This was a clandestine research and development agency, targeted with innovation that enabled the Allied powers to prevail in the war effort. After the war ended, President Franklin D. Roosevelt wanted to find a way for this country to continue the astonishing levels of progress that he had seen during the brief but intense period of the war. He posed questions concerning ways that the U. S. could make its scientific progress known without divulging national secrets,
how progress already made might help to combat illness and increase health, what measures the federal government should take to increase research and development in the peacetime economy. President Roosevelt asked in what would become the guiding principle for the academic STEM enterprise, “Can an effective program be proposed for discovering and developing scientific talent in American youth so the continuing future of scientific research in this country may be assured on a level comparable to that during the war?” (Bush, 1945, p. 3).

**Establishment of the National Science Foundation**

President Roosevelt’s questions led to the establishment of the National Science Foundation (NSF), which continues to be the premier federal agency targeting basic scientific research and development in the country today. Vannevar Bush became its Director once the war-time Office of Scientific Research and Development was disbanded. Part of the enabling legislation that established the NSF, the NSF Act of 1950, included the following in Section 3, (e):

In exercising the authority and discharging the functions referred to in the foregoing subsections, it shall be an objective of the Foundation to strengthen research and education in the sciences and engineering, including independent research by individuals, throughout the U. S., and to avoid undue concentration of such research and education (U. S. House of Representatives, 2012).

The caveat to “avoid undue concentration of such research and education” is very difficult to enforce. While geographic concentrations of funding are easy to identify, those that are reflected only by demographic information gathered on participants are
difficult to document and then to ameliorate. The federal government realized this at the
time of the NSF’s establishment, and made certain to set aside portions of its funding for
what were then perceived to be the main groups under-represented in STEM disciplines:
African Americans (Blacks), Hispanics, and Native Americans (Legal Information
Institute-d, 2015).

In 1980, the geographic concentration of federal R&D capacity and, hence,
funding, became apparent. Congress directed the NSF to establish the Experimental
Program to Stimulate Competitive Research (EPSCoR) to ensure that states or territories
that had historically “received relatively little Federal research and development funding”
(Legal Information Institute-g, 2015) participated more fully in the Nation’s scientific
endeavor. EPSCoR targeted efforts that enabled its jurisdictions (currently 27) to increase
their level of competitiveness through targeted competitions within those jurisdictions
designed to build their research infrastructure at a statewide or jurisdictional level.
Ultimately the descriptor of “experimental” became “established,” after the EPSCoR
program had been in existence for well over 20 years (K. Chu, personal communication,

Still later, in 2001, NSF established another program that targeted women in
STEM faculty positions, with an aim to more successfully recruit, retain, and promote
them through the ranks of their universities (Virginia Tech ADVANCE, 2015). This
program has funded many research projects that have examined a wide variety of
questions and proposed interventions to address gender equity disparity in American
academe’s STEM disciplines. The author included a variety of the program’s publications
discussing research findings on gender differences.
Research Findings on Gender Differences, with Specific Issues for STEM Faculty in Post-secondary Institutions

Retention, Promotion, and Mentoring

When examining ways to increase numbers of women in STEM disciplines at universities in the U. S., the issue of recruitment is not the major stumbling block: faculty in STEM disciplines seek universities with programs that resonate with their own interests. While women and men do not necessarily apply for and get hired into their faculty positions in equal percentages, there is a higher rate of attrition for women than for men once they begin their career paths (Xu, 2008). Therefore, the onus becomes retaining and promoting women in a more equitable fashion. Laursen and Rocque (2009) pointed out that effective mentoring of women requires a different mindset than the traditional one taught and learned in labs and classrooms of the past. Laursen (2015) went on to say that smaller universities that experience isolation due to geographic and/or cultural aspects have a greater need to tailor mentoring to suit the gender and cultural background of the faculty member, and more importantly address the culture of the university itself. The issue of the culture of the community in which the university is embedded must also be addressed in order to ensure the faculty member both bonds with the locale and is accepted by the community there (DeLoughrey, 2007).

Differences between men and women faculty members must be understood from the viewpoints of both mentors and those being mentored. Eagly et al. (2003) cited basic differences in the types of leadership demonstrated by men and women, and concluded these differences could result in differing levels of effectiveness in mentoring. This was true from both perspectives – for women and men as leaders/mentors and as those
led/mentored. In addition to the differences in types of mentorship perceived to be effective, the approach to networking among colleagues was also different among men and women (Xu & Martin, 2011). While they recognized that differing personality types would pursue networking in different manners, Xu and Martin (2011) cited the general similarity of approach on the parts of women and men.

Career Progression: Networking Styles and Mentoring Relationships

The need for effective mentoring, and the opportunities for establishing individual mentoring relationships that networking affords, should be investigated very thoroughly. As faculty move along the paths of their careers, from graduate school to post-doctoral appointments to faculty appointments and sometimes into the administration of their universities, their professional development is a never-ending process. Ideally, as the differences between men and women professionals become better understood, so too will their professional development journeys become more fulfilling and fruitful. Learning more about gender-based differences in professional development needs of STEM faculty will encourage the adaptive leadership model to provide for supportive adaptations. This will likely lead to better equity between the genders when it comes to retention and promotion.

Women’s Participation in the STEM Disciplines

Over the time span of approximately 27 years, women have made consistent gains in their representation in STEM disciplines overall: in 2015, they comprised 50% of the college educated workforce, up from 43% in 1993 (National Science Board, 2018). Despite gains in overall education levels, women still remain significantly underrepresented in STEM disciplines: 29% of the workforce were women in 2013,
whereas in 1993 that figure was 23% (National Science Board, 2018). Gains in overall representation notwithstanding, women’s rates of participation in engineering (15%) and physical sciences (28%) are far outweighed by those in the social (60%) and life sciences (48%) (National Science Board, 2018). Computer and mathematical sciences (26%) round out this picture of unequal representation in STEM disciplines by women (National Science Board, 2018).

The uneven degree of representation in STEM disciplines is something that the federal government has taken a keen interest in, and is actively trying to address (National Science Board, 2015). The approach in recent times expanded that of the original National Science Foundation mandate to strengthen STEM research and education while guarding against undue geographic concentration of resources (U. S. House of Representatives, 2012). The federal government more recently sought to “foster a strong, flexible, and diverse STEM-capable U.S. workforce” (National Science Board, 2015, p. 25). Recognizing the differences in motivations and psychological drivers of various demographic groups therefore becomes critical in order to ensure our nation remains both innovative and competitive on the world stage.

There is a plethora of literature on women’s representation in STEM faculty at universities, with studies having been conducted for at least four decades. While the results of studies about why women are underrepresented in STEM faculty positions differ, there is one overriding area of agreement: more work needs to be done to address the inequity (Ceci, 2014; Easterly, 2011; Gardner, 2013; Marschke, 2007; Misra, 2017; Xu, 2008). These studies agree that disciplines more reliant on mathematical interests or abilities on the part of practioners remain heavily skewed toward men’s participation, yet
they also state that this is not necessarily due to any biological predisposition toward mathematical ability.

Various types of educational institutions were investigated by the above referenced authors, with a variety of findings about women’s roles in them and the impact of organizational structure. In particular, universities that are in the middle of the educational hierarchy, comprehensive public universities that have a strong focus on education, increasingly rely on research as a means of improving their resource bases for items such as research materials and supplies, student assistants and other technical assistance, equipment, and travel funds for presenting results and the all-important networking (Gardner, 2013). This Dissertation in Practice is focused on such an institution. Findings of this study revealed trends in women’s vs. men’s experiences that informed the suggested recommendations ultimately proposed by the researcher.

**Risk Tolerance and/or Aversion as Pertains to Gender**

The vast majority of literature on risk tolerance and/or aversion pertains to economics; however, the findings of research conducted on the topic are applicable here. Research on gender differences in risk tolerance and risky decision making have revealed that the driving force behind arriving at decisions is based more in psychological aspects of gender identity than in biological gender assignments (Lemaster, 2013). Similarly, gender-related mindsets were found to have impact on confidence toward making decisions (Hugelshafer, 2014) – revealing a general tendency on the part of men to be overconfident in either implemental or deliberative mindsets. Hugelshafer (2014) defined the implemental mindset as one initiated by the act of deciding on a goal and beginning to plan for and pursue it, while the deliberative mindset was characterized by thinking about
a problem they did not have a solution for at the moment. Women’s confidence in
decision making was in line with their outcomes while in an implemental mindset, but
they revealed under-confidence when in a deliberative one.

While the writer found relatively little on the topic of risk tolerance in the
literature, one particularly relevant study discussed the roles of gender vis-à-vis career
choice and willingness to compete (Kamas & Preston, 2012). That study included in its
categories of career choices STEM disciplines – stating that as women were
underrepresented in STEM fields, they were able to achieve an in-depth understanding of
risk associated behavior (Kamas & Preston, 2012). Women in STEM fields were revealed
to be just as likely to enter competitions as men in the same fields, and their decisions
about whether or not to compete in winner-take-all tournaments or contests was
unaffected by the man-woman composition of the competitive fields (Kamas & Preston,
2012). This fundamental difference in women who pursue careers in STEM fields is very
interesting to this writer and suggests the risk tolerance of women who enter such fields
is higher than that of women in other fields and perhaps even of men in STEM.

Another study revealed interesting findings about when or if women would enter
a competition – stating that women scored higher on the scale of neuroticism as a general
rule, and generally entered competitions less frequently, while women who did compete
willingly and competently demonstrated lower scores on the neuroticism spectrum
(Muller, 2012). STEM faculty positions at universities are very competitive workplace
settings, so this finding was especially relevant to the researcher. This researcher believes
that the leadership style present in university settings, and women’s willingness to engage
in competition, are a driving force in their entry to STEM disciplines and their
willingness to leave them to pursue more rewarding careers even with less assurances of success, when faced with negative climates in their faculty settings.

**Leadership in Academe**

The author employed an adaptive leadership approach to this study, mainly because this topic is under a constant state of change from all levels. Use of the adaptive leadership model allows for the individual as well as the organization, at any level, to engage in change targeted at achieving specific goals (Adaptive Leadership, 2017). Literature about using the adaptive model goes into some detail about risk and how to manage it as part of the change process (Heifetz, Grashow, and Linsky, 2009). The adaptive model is especially suited to leadership in rapid change, or even in crisis mode – thereby making it ideal when addressing practices that need to be changed or at least assessed for their efficacy (Heifetz et al., 2009).

**Summary**

This literature review provided a historical background of the scientific research and education endeavor in the U. S., with an eye toward anchoring the issue of women’s underrepresentation in it as an important factor for the nation’s global position in innovation. Research findings concerning men and women in STEM, especially at post-secondary institutions of education, were presented as regards retention, promotion, and mentoring.

The review went on to discuss risk tolerance and aversion as demonstrated by gender. In particular, how risk tolerance affects willingness to engage in competitive behavior was discussed. This was an important factor in how women and men approach challenges in their career paths.
CHAPTER THREE: METHODOLOGY

Introduction

Because the researcher’s career has been focused in the STEM disciplines in post-secondary institutions in the U. S., this study focused on the population of STEM faculty. In order to elicit insights from members of the target population about why they made the career path choices they did, the researcher designed interviews to collect data directly from participants in at least two long-standing programs aimed at increasing competitiveness and participation in federally funded research and training programs at the National Science Foundation (NSF).

A primary consideration in the research plan and discussion of any findings was to protect the anonymity of the participants. Toward this end, any quotations used were not attributed to a specific person but rather anonymized, and any trends revealed were discussed in the aggregate.

Research Questions

Despite a wealth of information about attrition rates of men vs. women from STEM faculty positions in post-secondary institutions in the U. S., little progress has been made in addressing the higher rates of women leaving their positions (National Science Board, 2018). The author of this Dissertation in Practice sought to learn from members of the target population what if any differences they had in how they perceived their roles in their positions, and what their risk tolerance was regarding staying in or leaving them due to gender-based challenges. Using the existing data and combining that review with interviews of men and women who are in STEM faculty positions resulted in
a rich pool of information about both the faculty recruitment, tenure, and promotion process and the perceptions of those experiencing it.

The questions this Dissertation in Practice sought to answer were: *Is there a difference in women and men’s risk tolerance that leads them to stay in or leave from their positions more readily? How do differences between men and women in STEM faculty positions affect the retention and success of women in those positions?*

**Research Design**

In order to determine which research method was best suited to this study, the researcher consulted Creswell (2014), deciding on qualitative research methods. Beginning on page 184, the following aspects of this type of research methodology presented as pertinent to the study at hand:

- The researcher endeavored to gather data from as natural a setting as possible, by scheduling interviews with participants via telephone (due to the researcher’s isolation at a home institution in Hawai‘i);
- The researcher was the key gatherer of data, and that data came in multiple formats such as existing studies and surveys, and interviews designed by the researcher directly;
- The researcher endeavored to learn the meaning that the participants attached to the process of STEM career progression in post-secondary institutions;
- The process of this research was emergent in nature: this researcher altered the basic question being asked, and kept an open mind as interviews were completed and participants’ experiences revealed themselves;
This study was both reflexive and holistic: the researcher was a member of the post-secondary STEM population, albeit not in a faculty track, and the research itself examined the issue of disparate rates of attrition between women and men from many perspectives.

Creswell (2014) presented a table in his book that laid out the various aspects of qualitative methods and their characteristics, which is included here as Table 1, with cells relevant to this study highlighted. This researcher concluded that a phenomenological approach was best suited to understanding why women and men have different rates of retention and success when going through the process of recruitment, hiring, and award of tenure and promotion in the STEM disciplines of post-secondary institutions.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Narrative Research</th>
<th>Phenomenology</th>
<th>Grounded Theory</th>
<th>Ethnography</th>
<th>Case Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Exploring the life of an individual</td>
<td>Understanding the essence of the experience</td>
<td>Developing a theory grounded in data from the field</td>
<td>Describing and interpreting a culture-sharing group</td>
<td>Developing an in-depth description and analysis of a case or multiple cases</td>
</tr>
<tr>
<td>Type of problem best suited for design</td>
<td>Needing to tell stories of individual experiences</td>
<td>Needing to describe the essence of a lived phenomenon</td>
<td>Grounding a theory in the views of the participants</td>
<td>Describing and interpreting the shared patterns of culture of a group</td>
<td>Providing an in-depth understanding of a case or cases</td>
</tr>
<tr>
<td>Discipline Background</td>
<td>Drawing from the humanities including anthropology, literature, history, psychology, and sociology</td>
<td>Drawing from philosophy, psychology, and education</td>
<td>Drawing from sociology</td>
<td>Drawing from anthropology and sociology</td>
<td>Drawing from psychology, law, political science, and medicine</td>
</tr>
<tr>
<td>Unit of analysis</td>
<td>Studying one or more individuals</td>
<td>Studying several individuals who have shared the experience</td>
<td>Studying a process, an action, or and interaction involving many individuals</td>
<td>Studying a group that shares the same culture</td>
<td>Studying an event, a program, an actitity, or more than one individual</td>
</tr>
</tbody>
</table>
Phenomenology, as a qualitative method, made use of the data about the phenomenon of the higher attrition rate for women in STEM faculty positions at universities. Self-selected participants of both genders were interviewed in order to gather their perspectives on their experiences. The researcher made use of certain existing quantitative data included in such documents as Science and Engineering Indicators (National Science Board, 2018), that provided the background for assertions about which disciplines women are most underrepresented in and what the trends were for their changes in that representation.

**Participants/Data Sources and Recruitment**

The researcher initially worked with Program Officers at the National Science Foundation whose programs have published the most relevant findings about women STEM faculty’s higher rate of attrition to secure permission to solicit participation in in-depth interviews of members of their funded projects. These Program Officers indicated interest in this study during informal contact by the researcher, and their cooperation was expected in the form of permission to use program listservs for purposes of inviting likely interviewees. These types of broadly disseminated invitations to participate in surveys or interviews had been distributed in the past via listservs and conference web sites. That plan did not work out as expected, due to delays in implementing the interview invitations and subsequent retirement and reassignment of NSF personnel who had previously been open to allowing use of said listservs. Rather than use NSF-sponsored listservs as initial dissemination tools for inviting likely interviewees, the researcher used listservs established and managed by the awardee programs’ administrators themselves, with permission from those listservs’ managers. She also used the listserv for faculty at
her home institution, which participates in both NSF programs under consideration, and issued personal invitations to several members of the Academy who had been part of those programs.

An example of the interview recruitment message was included as Appendix A. The population to which this invitation was distributed was a national pool of scientists/engineers on NSF-funded research projects that deal specifically with inequities in gender-based workplace issues and issues surrounding research competitiveness improvement. The population consisted of faculty at all types of post-secondary institutions across the U. S., including but not limited to primarily undergraduate four-year institutions, research-intensive institutions, community colleges and other two-year campuses, Historically Black Colleges and Universities, and Tribal Colleges and Universities.

Because the researcher anticipated a wide variety of respondents, demographic information was gathered that included but was not limited to the participant’s gender, type of faculty position the participant was in, length of service in academe overall and at their current institution, and discipline and level of the participant’s highest degree. The request for this information clearly explained that none of the details about participants would be revealed in such a way as to identify any of them in the reporting of findings. Each interviewee was offered a copy of the dissertation upon completion at no cost, in a downloadable file.
Data Collection Tools

The main data collection tool was an interview designed by this researcher. This interview protocol was included as Appendix B. The researcher anticipated correctly that, due to physical isolation in Hawai‘i, the interviews needed to be conducted by telephone.

Interview questions were open-ended in order to allow the interviewees to reflect on their experiences. Interview questions were delivered in the exact same order over the course of each interview, following the script within the interview protocol.

Data Collection Procedures

Participants were invited via email messages (see Appendix A) sent to lists provided by NSF ADVANCE and EPSCoR administrators and to the faculty listserv at her home institution. A dedicated email address was used for this invitation process, to which willing participants replied. Each participant was sent an interview protocol (see Appendix B), and offered the opportunity to serve as a member-checker of the transcripts of their individual interview (Creswell, 2014).

All legal obligations associated with this process were covered under the auspices of approval of the protocol by Creighton University’s Institutional Review Board.

Ethical Considerations

The researcher followed all Creighton University Institutional Review Board procedures for this Dissertation in Practice. The email invitation to participate in the interview process is included in as Appendix A of this proposal in its entirety. The Interview Protocol is included as Appendix B, and the Informed Consent is included as Appendix C.
Identities of participants were protected by generation of random codes for each participant, using the Excel random code generator functionality. Audio recordings of the interviews were created for purposes of transcription. After transcription, transcripts were sent to each interviewee for vetting. On receipt of either approval of the transcript as sent, or edited according to the respondent’s instructions, the audio recordings were destroyed.

All files of transcriptions were kept in a password-protected electronic file. Each interviewee was assigned a randomly generated code to ensure anonymity. A non-attributed list of participants and their email addresses was kept separately in order to allow the dissertation to be forwarded to any participants who requested a copy of it.

**Data Analysis Plan**

Creswell’s (2014) process beginnning on page 197 was followed. This included:

- organizing and preparing the data for analysis;
- reading all the data;
- beginning to code the data by following Tesch’s (1990) eight steps (p. 198),
- using the coding process to create a description of the participants, their settings, and categories of themes that presented themselves;
- advancing how the themes were presented in the narrative of the findings;
- making an interpretation in qualitative research of the findings.

Each interview was transcribed verbatim within 24 hours of its occurrence. Initial coding of interview responses was via open codes such as gender, faculty rank, STEM discipline, and length of time in the discipline and/or at the specific university. The researcher hand coded responses.
The researcher then reviewed, in an immersive fashion, all the interviews as a body of knowledge. Only after the researcher became embedded within the language of the participants’ responses to the interview questions was subsequent coding of responses undertaken. It was during this phase of the analysis that the researcher’s bracketing skills were most needed. Bracketing is a term applied to the deliberate accounting for biases, presuppositions, beliefs, values, preconceptions, personal or professional history, and other underlying aspects of the researcher’s own mindset that is being brought to bear on the research and analysis of the data (Tufford, 2010). Essentially, the practice of bracketing recognizes that the researcher makes a conscious attempt to set aside personal background or thinking while gathering and analyzing data.

Secondary coding of responses took into account such details as the participants’ use of language to describe their professional experiences, their identification of feelings of accomplishment or challenge and how they reacted to those feelings, their descriptions of the climates in their work places and how those climates affected them, and even their aspirations for future professional and/or personal accomplishments. In this manner, the researcher created a framework for how to categorize responses.

**Ensuring Validity and Reliability**

As a method of ensuring validity, the researcher inquired of interview participants whether they might be willing to serve as volunteer member-checkers. Member checking is accomplished by the researcher having participants review parts of the finished or semi-finished product for accuracy (Creswell, 2014). Interviewees were provided with the verbatim transcripts of their individual interviews and thus participated as checkers of their own inputs to the Dissertation in Practice.
Additionally, a peer debriefer was engaged. Peer debriefing is similar to member-checking except that the peer debriefer is not previously associated with the project or the product – it is not only a review of the work by a fresh set of eyes but also a quality check of it, by the debriefer asking questions of this researcher (Creswell, 2014). This peer debriefer, who performed the task *pro bono*, was of invaluable assistance to this researcher as she enabled this researcher to step back and re-analyze results from the perspective of the research questions instead of simply analyzing the answers to the interview questions. Further measures suggested by Creswell (2014) to ensure validity that this researcher employed included the researcher’s acknowledgement of biases brought to the study, and inclusion of any unexpected or possibly negative findings encountered.

In order to ensure reliability of the data, the primary measure was verifying that the transcription of the interviews was verbatim. Such checking of the transcripts (Creswell, 2014) was conducted both immediately after the transcript was created, and again after a day or so. In this researcher’s experience as a writer and editor, this period of time away from primary source material was helpful in providing a fresh perspective when checking work.

Ensuring against drift in codes – a shift in their meaning that might occur during the process of coding – helped to ensure reliability of the data (Creswell, 2014). The researcher engaged the help of the peer debriefer to go over transcripts after they had been coded, in order to check for drift.
Timeline for the Study

The researcher’s time to completion of this study had two major interruptions, each associated with the illness and death of an immediate member of her family, during which times she acted as primary caregiver.

- April 2018: Completed the proposal process and achieved approval by the Committee; literature review of pertinent reports and peer-reviewed articles continued; IRB approval was granted via Creighton University’s internal procedures in December 2018.

- January – February 2019: Researcher contacted Program Officers of selected National Science Foundation programs (NSF ADVANCE and EPSCoR) to discuss dissemination of interview invitations, via email. Language of these interviews was submitted to Program Officers for their review (see Appendix B, Interview protocol). Literature review of pertinent reports and peer-reviewed articles continued.

- March 2019: Interview invitations disseminated; literature review of pertinent reports and peer-reviewed articles continued.

- March 2019: Participants’ responses to the invitation were reviewed and a list of interview subjects was created; literature review of pertinent reports and peer-reviewed articles continued. Interviews conducted via telephone.

- March – April 2019: Interviews complete. Analysis of responses began: each interviewee was assigned a randomly generated code id; literature review of pertinent reports and peer-reviewed articles continued; responses were coded according to their frequencies and themes.
May 2019: This was the beginning of a terminal illness for an immediate member of the researcher’s family – her brother, who passed after a painful and fearful battle in November 2019. His illness was the second such caregiver role the writer found herself in, having provided similar care to her mother during most of 2018. These two back-to-back experiences took a huge toll on this researcher’s ability to attend to academic endeavors.

August 2019: Analysis of data continued; literature review of pertinent reports and peer-reviewed articles concluded.

November 2019: One final delay allowed for completion of this Dissertation in Practice due to her brother’s death.

January – February 2020: Rewrite of Chapter Four completed satisfactorily. Chapter Five outline delivered to Committee Chair.

March 2020: Chapter Five submitted to Committee Chair.

April 2020: Submitted final draft of Dissertation in Practice to committee for review before defense.

May 2020: Successful defense of the dissertation.

Reflections of the Researcher

This researcher has been on a life-long educational journey for many years, beginning with modeling for the researcher’s children and now for their children the value of continually improving one’s education and intellectual capacity. As a research administrator of several NSF research and/or training awards, one topic of conversation that has become common to this author is that of the question about why women seem to leave STEM faculty positions at a higher rate than men do. The question under
consideration came about almost in jest: instead of asking why more women leave, why aren’t we asking why more men stay? This “flipped” question was put forward to several influential people in academe and the federal agencies (Chancellor of the West Virginia Higher Education Policy Commission, National Head of NSF EPSCoR, Senior Vice President of The Implementation Group of Washington DC, among others), and met with universal intrigue. This has become an exciting quest for this researcher at a time when retirement is a viable option. Instead of retirement, however, this writer envisions becoming a consultant to other projects and institutions that are trying to address the inequities in gender-based employment policies and practices in the Academy. As this Dissertation in Practice progresses and that light at the end of the educational tunnel finally begins to grow in diameter, a new career path is also illuminating.

**Summary**

This section of the Dissertation in Practice has discussed the research methodology – which is based in the qualitative Phenomenology method. Data collection parameters were discussed, including how participants were recruited and how their identities were protected. Data analysis was outlined, and a timeline for completion was created. Invitation to participate, interview protocol, and informed consent documents were included as appendices as well. Finally, the researcher was provided with an opportunity to reflect on this process.
CHAPTER FOUR: RESULTS AND FINDINGS

Introduction

The purpose of this qualitative Dissertation in Practice study was to determine if differences in perceptions between men and women in STEM faculty positions may affect the retention and success of women in those positions. The specific questions the dissertation sought to answer were: Is there a difference in women’s and men’s risk tolerance that leads them to stay in or leave from their positions more readily? How do differences between men and women in STEM faculty positions affect the retention and success of women in those positions?

This section of the dissertation presents findings of the researcher’s interviews with the subjects who participated and steps taken during implementation of the methods. A description of the participant population is given, to apprise the reader with a sense of who provided insights to the researcher – gender, faculty rank, stage of career, and whether the respondent was a member of a spousal couple at an institution. Themes of respondents’ answers are presented, and an analysis of those themed responses follows. The researcher first analyzed the responses simply according to the interview questions. Once those responses were analyzed, she then identified trends that addressed the two specific research questions.

Participants/Data Sources and Recruitment

National Science Foundation Listservs

The researcher originally intended to work with Program Officers at the National Science Foundation from two programs designed to address issues of underrepresented groups in research: the ADVANCE program, which has published relevant findings about
women STEM faculty’s higher rate of attrition within the Academy; and the EPSCoR program (the Established Program to Stimulate Competitive Research), which seeks to improve research competitiveness at a jurisdictional level (state and/or US territory) by improving research infrastructure and addressing issues of uneven participation in research by certain demographic categories, including women. She sought permission to solicit participation in in-depth interviews of members of the two programs’ funded projects. Although the Program Officers indicated interest in this study during informal, preliminary contact by the researcher, they ultimately proved reluctant to allow use of their programs’ listservs for purposes of recruiting participants. Instead, they suggested the researcher contact separate listservs maintained by networks of their programs’ Principal Investigators (PIs) and Project Administrators (PAs).

The researcher used two listservs to send out her email invitation using a discrete email address established specifically for the purpose of this dissertation and received a low rate of response over the course of a week. (See Appendix A for the language contained in the email interview to participate.)

**Direct Invitations and Use of the Researcher’s Home Institution Listserv**

The author also sent out direct invitations to participate to four known members of the identified research communities, using the language of the broadcast invitations. All four agreed to participate. Additionally, she sent the email invitation to the faculty and staff listserv at her own institution, which is a participant in both NSF programs.

A total of 36 respondents from the researcher’s home institution listserv indicated a willingness to participate in the interview process. Of those, four proved unresponsive to scheduling requests after three attempts and were eliminated. A further 11 were culled
from the list as poor fits with the desired subjects: four were from non-STEM disciplines, while seven were not pursuing faculty positions and never had.

**Implementation of Data Collection**

Data were gathered via an interview designed by this researcher (see Appendix B.) Due to physical isolation in Hawai‘i, and to ensure consistency in the method of interaction with respondents, the interviews were conducted by telephone. Average duration of the calls was 27 minutes; the range of duration was between 13 and 47 minutes. Each interview was recorded digitally and transcribed verbatim.

On completion of the transcription, the transcript was sent as a Microsoft Word document to the subject for validation and correction of any discrepancies or misinterpretations of responses. Only three respondents had changes to make, all of which had to do with their own grammar. No substantive changes were requested. Interview recordings were deleted once the transcripts were vetted by the subjects. In this manner, the subjects provided a form of self-checking of their responses.

**Participant Population**

**Categories and Gender Count and Percentages**

The population of interviewees was analyzed as to gender, faculty rank, stage of career, and whether the respondent was a member of a spousal couple at an institution. There was a pool of 25 respondents. Of those, 15 (60%) were men and 10 (40%) were women.

**Faculty Rank Count/Percent and Gender Count/Percent among Ranks**

Faculty rank was categorized as follows: Assistant Professor (n=5, 20%); Associate Professor (n=1, 4%); Professor (n=10, 40%); Retired (n=3, 12%); and Other
RISK TOLERANCE OF WOMEN IN STEM FACULTY

(n=6, 24%). Members of the “other” category included those who had been tenure tracked faculty in STEM fields and left for other concerns (n=1); museum and/or federal agency personnel who hold affiliate faculty positions at the researcher’s home institution and participate actively in research and training projects there (n=3); a faculty member at the researcher’s home institution who is in a non-tenure track position while completing the dissertation to enable entry to a STEM tenure track one (n=1); and a faculty member from the researcher’s home institution who left a tenure track STEM position for private industry and subsequently returned to academe at a community college campus within the same home institution’s system of campuses (n=1).

Retired participants included a former university professor who began his career in Engineering (n=1), a former state-wide Chancellor of Higher Education whose faculty tenure track path was in chemistry (n=1), and a former director of a marine science based research institute whose disciplinary focus was virology in marine organisms (n=1). Two of the respondents (8%) were former National Science Foundation Program Directors.

Table 2 shows the overall faculty breakdown by rank, while Table 3 shows rank broken down for women respondents. Each table indicates number of faculty members and percent of their category for the rank being displayed.

<table>
<thead>
<tr>
<th>Overall Faculty Rank of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asst Professor</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>20%</td>
</tr>
</tbody>
</table>
Table 3

<table>
<thead>
<tr>
<th>Faculty Rank of Women Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asst Professor</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>20%</td>
</tr>
</tbody>
</table>

Spousal Pairs

The pool of respondents included three spousal pairs, all in heterosexual marriages. Two of the couples were pursuing their careers at the researcher’s home institution, and had done so for their entire tenure-track path. The third couple had spent a portion of their careers there and married during that time, but subsequently left for another university. That couple continued as affiliate faculty at the researcher’s campus and as active researchers there.

Career Stages of Respondents by Count and Percent

Six respondents (24% of the population) were early in their careers, defined as either at the Assistant Professor rank or still working toward the terminal degree in order to enter the tenure track. Eleven (44%) were mature in their career paths – defined as having attained at least Associate Professor rank and having up to 20 years in the tenure track. Eight (32%) were advanced in their careers – defined as either having more than 20 years in the tenure track or having already retired.

Data Analysis

The researcher initially planned to use NVIVO software to code and analyze interview responses, but this proved impractical. She subsequently decided to code the responses herself, based on training she had received earlier in her career from a former mentor, Dr. Lois-ellin Datta.
Initial Coding

The researcher initially coded responses by interview question – going through each respondent’s answers to the nine questions posed and grouping them together into a single thread for each inquiry. This resulted in nine sets of analytical categories being created:

- Reason for choosing the respondent’s specific discipline;
- Who the respondent’s mentors were and how they influenced him or her;
- Difference noted, if any, in how men and women provide counseling and mentoring;
- Gender-based challenges noted along the career path and actions taken to address them;
- Whether the respondent has enough time to pursue research and other scholarly activities;
- The respondent’s idea of a perfect academic position;
- How their recruitment and interview process compared with their “perfect” image;
- How their current position is either fulfilling or failing their expectations for the position they were recruited to, and how might they go about achieving their goals with respect to their professional aspirations;
- Other topics they wanted to mention or circle back to.

The researcher categorized responses to the interview questions by gender and then attributed the respondent’s other parameters (faculty rank, stage of career, and
whether the respondent was a member of a spousal couple at an institution). She then analyzed the same set of responses vis-à-vis the research questions.

Research question 1: Is there a difference in women’s and men’s risk tolerance that leads them to stay in or leave from their positions more readily?

The phenomenological approach used by this researcher allowed interviewees to express themselves openly in the series of questions that were designed to provide opportunities to reveal personal levels of risk tolerance. The respondents’ answers revealed more commonality than difference. Expectations of faculty with respect to their positions seemed to be more tied to their ages than to their genders. Women faculty in the more mature to advanced stages of their careers had less expectation of equal treatment overall. Men in that same age range expressed feeling threatened by the current atmosphere of assertive (“aggressive”) women, while their women counterparts and/or younger faculty members did not.

The researcher analyzed reasons given by respondents for their initial choice of a career in STEM in academe. She then turned to respondents’ revelations about their image of the perfect academic position, especially vis-à-vis their own recruitment and interview process.

Reason for Respondent Choosing the Discipline

Curiosity. The overriding motivation for pursuing STEM in general was a sense of curiosity. Virtually all of the respondents expressed some form of desire to find out about the natural world, learn why things happen the way they do, or understand the world around them.
Affinity for Lab Work. A subset of the respondents also expressed an affinity for laboratory work (with one respondent who had achieved international standing as a virologist and who held several patents for vaccines stating that she pursued her career because, “You know, I had always wanted to wear a white lab coat.”). Others were more focused on asking questions with answers that would be found through field work. They noted that working with mentors in various stages of their lives – from childhood to adulthood – guided their identification of a specific scientific discipline.

Making a Contribution. Certain among the respondents were drawn to the Academy in order to contribute to society at large, with only two of them expressing that they were fond of teaching. None exactly spoke out against teaching, but they often viewed it as a burden they had to bear or the price they had to pay in order to be allowed to pursue careers that enabled them to continually satisfy their curiosity.

Mentors’ Influence on Respondents’ Choices. Respondents who shared that they were influenced by parents or other family members in their career path choice numbered seven. Of those, three related that at least one of their parents exerted a positive influence. These experiences included camping and hiking, trips to parks and museums, or modeling while pursuing their own careers.

One female respondent noted that an influencer who was a man had a dramatic negative impact on career choice, such that the interviewee wanted to always remember how not to behave as a scientist. Another related that a man had a positive impact, while yet another stated that an influencer who was a woman – in this case the respondent’s mother – provided positive impact.

The Perfect Academic Position. There were eight overall trends revealed in the
answers to this question. As proved to be the case with other inquiries, the responses were diverse and wide ranging. No one answer was limited to a single consideration.

Trends are listed below in descending order of occurrence:

- There is no such thing as a perfect academic position – a wide variety of considerations enters into this judgment (n=19);
- The perfect academic position will place a higher emphasis on research than on teaching (n=18);
- The institution must be administratively supportive of the faculty (n=17);
- There must be a strong sense of community, with opportunities to contribute to society at large and to the institution’s local community, and with a high degree of buy-in on the part of the institution to support such involvement (n=15);
- Teaching should be more highly regarded than research (n=7);
- Financial considerations are a high priority – salary, benefits, etc. (n=6);
- Diversity among faculty and staff as well as students is important (n=4);
- The institution should have a small faculty (n=1).

Recruitment and Interview vs. the Perfect Position

Four distinct trends were revealed when analyzing answers to this question.

Twelve respondents revealed that their interview and recruitment process had been unremarkable – stating they had gone on what they described as “the usual” round of interviews, research and/or teaching presentations, and meetings with potential fellow faculty members within their departments.

Of those who related less than ideal experiences, 11 stated that the process had been politically and/or personally stressful. One of those indicated she had interviewed
during a faculty strike, and her department chair had actually left a picket line to talk with her, but no one was supposed to know about that. Others said the pace of the visit was so hectic it induced stress responses – headaches, exhaustion.

By contrast, there were nine who said their recruitment and interview had been politically unrestricted, and it had been clear the Dean was in charge of the whole process.

Six indicated the financial considerations were disappointing. Of those, two who were both women stated this reflected back on themselves for having negotiated poorly on their own behalf.

Current Position vs. Expectations, and Actions Taken to Address Challenges

One universal response to this question arose: all 25 respondents noted that their institutions expected faculty to seek extramural funds but did not provide sufficient administrative support once the funds were garnered.

Nineteen stated that one’s position is what one makes of it. They all related during their responses that they had created the best situation for themselves that they could, given what was available at their own institutions. This included such strategies as hiring students and technicians to help carry out research so the faculty member could teach; incorporating some of their research agenda into their teaching; buying out their teaching time with extramural grants, and other creative solutions to perceived challenges.

There were 17 who stated that either their expectations had been primarily met, or that they had not faced any significant challenges in launching and pursuing their careers.

Twelve stated there was too much time required to be devoted to teaching to be able to conduct research or mentor students. Six related that they felt their institutions
should provide better training to them on how to be effective undergraduate teaching faculty, and how to mentor students well.

Ten respondents said that their experience at their institutions had been inconsistent over time, and occasionally corrupt. This was in regard specifically to the tenure and promotion process, which one faculty member stated was not the same from year to year. According to that person, in some years the emphasis was placed almost solely on teaching while in others it was heavier on scholarly activities – research, publications, etc.

**Research question 2: How do differences between men and women in STEM faculty positions affect the retention and success of women in those positions?**

In order to achieve a deeper understanding of the respondents’ answers vis-à-vis this question, the researcher analyzed the interview questions that related to who respondents’ mentors were and how they influenced their career paths, what if any differences the mentors demonstrated based on their genders, what if any gender-based challenges the faculty members themselves noted during the course of their careers and how they dealt with them, and whether they had sufficient time to pursue research and other scholarly activities.

Women faculty members who were in the advanced stages of their careers, or who had retired, had a marked sense of needing to work harder and be more assertive about their roles within the Academy. Additionally, they mentioned that their positions were often attributed to their gender rather than their talent or skills. One woman stated that her faculty advisor had a reputation as a womanizer, so she always had to be
One woman who retired as a world-renowned marine science and virology researcher told the story of engaging in a lawsuit as an associate professor, battling to overcome a $16,000/year salary inequity with her colleague who was a man and was just being hired as an assistant professor, not even tenured yet. She also had a much higher load regarding student contact hours (defined as one hour of direct instruction time, or at least 50 minutes of classroom instruction). She was required to put in 36 contact hours, as opposed to her nearest colleague, a man, who had only 20.

Men and women faculty members related their professional positions shaped up differently from each other. This took the form of how they were mentored, how they offered mentoring, and what kinds of workloads they experienced. One woman, mature in her career and part of a spousal pair, related that the impact of students’ evaluations and attitudes in the classroom had a profound impact on her experiences as a faculty member. Another man related that he had discovered the evaluations of students on faculty women were often scathing against such things as their dress or hair style and manner of speaking, while having little to do with the material being presented in the course(s) being taught.

**Respondent’s Mentors**

This category proved very diverse in its responses. All of the respondents reported multiple tales of mentors’ identities, genders, and roles in their lives. Five categories of mentors were revealed, with three of those categories having sub-sets:

- Family members (n=4);
- K-12 teachers (n=6)
  - Two were identified as women,
  - One as a man,
  - The remaining three not identified by gender;
- Friends (n=4);
- Faculty members (n=76)
  - Of those, 42 identified as men,
  - While 22 were women,
  - And the rest with the gender unspecified, including one spousal pair who mentored as a team.
- Seven mentors were in the category of “other”
  - Six of them were coworkers (two women and four men),
  - One park director during the respondent’s childhood.

*Differences Noted in How Men and Women Provided Counseling and Mentoring*

This category again proved very diverse in its range of responses. Seven themes were revealed during responses, in descending order of frequency. Those themes were:

- Women provided mentoring that allowed them to become more personally involved with the person being mentored (n=21);
- Each mentor was an individual, with the respondent specifically stating that the mentor’s gender was unrelated to the type of mentoring offered (n=21);
- Men provided mentoring that was mostly focused on work-related advice (n=12);
Women took their mentoring more seriously than men and kept themselves more reserved personally (n=12);

Men sought personal gratification from the mentoring they offered (n=3);

**Gender-based Challenges and Actions Taken to Address Them**

Analysis of responses to this question broke into two parts: gender-based challenges and actions taken to address them.

**Gender-based challenges noted along the career path.**

*No Gender-based Challenges Noted.* Certain men expressed not having experienced any (or very few) gender related challenges during their careers (n=13). Of those respondents, two expressed their belief that women currently use their gender as some sort of shield to deflect what would otherwise be simple career path challenges by calling them out as gender-based. Three women stated they had not experienced professional challenges that were based on gender.

*Gender Related Challenges Favored Toward Men.* In this category, four respondents noted that women administrators or other types of superiors demonstrated unsupportive behavior toward their colleagues who were women. All of these respondents were women. These statements related not only to professional concerns but also to safety concerns. A further two women responded with statements concerning students who were men who expressed gender-based hostility towards them that caused them to feel unsafe in their work places.

*Challenges That May Also Have a Basis in Culture and Locale.* Nine respondents expressed that they had faced professional challenges during their careers that seemed to have a basis in culture and place of work as much as they did in gender.
While the researcher recognizes that every locale has its own set of cultural and place-based parameters, Hawai‘i is perhaps a locale that carries a stronger set of cultural and locale-based parameters for those in post-secondary education and research due to its indigenous culture playing a strong role in the fabric of the University itself (UH Hilo, 2015).

**Challenges Related to the Type of Institution Where One Worked.** Four respondents shared that they felt the challenges they had experienced were more a function of the type of institution they were at than based on gender. These faculty members were either at the mature or advanced stages of their careers, and had experienced two or more tiers of post-secondary institution as their base: primarily undergraduate, community college, and/or research-intensive.

**Academe as Having a Family Unfriendly Atmosphere.** In this set of responses, there were seven discussions about the Academy being family-unfriendly. Of those, four were related by men and three by women. Two men related the only reason they had been able to pursue their careers as aggressively as they had was due to their wives having taken on the majority of family responsibilities. One in fact stated his wife had shouldered 90% of that load during their children’s younger years. One of the men stated that due to the atmosphere in academe being intolerant of faculty beginning and raising their families, he had delayed starting his own.

This researcher noted earlier that there had been three spousal pairs as part of the population of respondents. Of those, two pairs had raised children while pursuing faculty positions. One couple consciously scheduled their teaching time such that they were able to be available to their children at all times – alternating days, but consistently providing
at least one parent to be physically available at least until high school graduation. That
couple’s children have gone on to become UH Hilo students, and the family meets daily
for lunch in the cafeteria. The other couple did not relate their specific parenting history.

**Other Challenges Noted.** There were two other types of career challenges noted
by interviewees. Three men noted they felt as men they were expected to remain in their
chosen fields but women had more flexibility to modify their career paths. While there
were two women who talked about their choices to leave positions or change institutions
at which they worked, no women expressed feeling more flexibility in their choices
specifically.

Two other men, both in advanced stages of their careers, expressed that all faculty
members owed a debt of gratitude to the clerical staff at their institutions, no matter
where they were. Both of those men referred to their clerical staff as women.

**Actions Taken to Ameliorate Gender Related Challenges.** Of the mix of
respondents who noted gender related challenges (including those who noted that they
may have also had a basis in locale and/or culture), there was a diversity of actions taken
to ameliorate them.

**Work Harder.** Seven women expressed that they undertook to work harder than
their counterparts who were men – shouldering a heavier load of committee and
community service work as well as a higher academic load. Likewise, a group of seven
women indicated they undertook to ensure that their authority was evident while not
becoming shrill. These strategies were implemented only by women. No men expressed a
consideration over their tone of voice.
Insist Women are Included. Three women made sure the men they worked with on committees and in creating workshops or conferences took steps to include women. One woman who was retired and so had a long career history to look back on went so far as to say she would insist that at least one woman be seated on steering or hiring committees and not allow the men in charge to say they had tried to recruit a woman but were unsuccessful. Her position was that if no woman had been recruited, it was because the men doing the recruiting were not diligent enough, or even that they were not being genuine in their efforts to recruit at least one woman to the role.

Ensure Your Success is Recognized as Your Professional Accomplishment. Three women stated they were adamant in making sure that when they were recognized for their success, it was recognized as a professional accomplishment and not one based on their gender.

Take Legal Action. Only one respondent related that she had taken legal action to address an unequal workload and pay discrepancy. This had occurred in the 1970s, as she was just beginning her faculty career. This woman also related that she deliberately sought membership in a professional society that had previously been open only to men. She stated:

You have to fight. If you ask for something that you deserve and you don’t get it, you must ask again. But when you do ask again, you have to be prepared and you have to fire everything you’ve got at them. You have to fight. (Interviewee #28, March 11, 2019)

Advice. When talking about actions taken to address gender related challenges, the following pieces of general advice arose:
• Do not take gender-based biases personally – remember the failure is in those biased, not in you;
• Recognize that achieving gender neutrality or parity is a long-term process – keep working at it and don’t give up;
• Become a mentor to entering faculty – men as well as women – to pass along your experience base.

Sufficient Time for Research or Scholarly Activities. Seven respondents indicated an affirmative answer to this question. There was a mix of reasons cited by those relating negative answers to this question, with interviewees often providing more than one explanation for their lack of time for such endeavors:

• Due more to a lack of institutional resources than other distractions (n=9);
• The nature of curiosity is that it always leads to asking more questions, so one is continuously adding to one’s own research agenda (n=9);
• The administrative load that the faculty member fulfills at their institution precludes active pursuit of research (n=7);
• Being drawn in so many different directions as one is at a primarily undergraduate university – teaching, researching, administering one’s projects, and being involved in community service – would always result in insufficient time for anyone to be pursued to satisfaction (n=2).

Other Topics. This final question among the initial interviews gave respondents the opportunity to share their final thoughts about the topic of their careers in STEM within the Academy. Six distinct themes were noted in responses to this last, open-ended question.
Five interviewees who were classified as in the advanced stages of their careers reflected on their years of service, and on the changes they had noted in both the Academy and society at large. They all stated that women’s roles in the Academy had improved vastly over time, but also recognized that there was still a long way to go before parity would be achieved.

Four shared that there is a marked difference in academic approaches and those used traditionally in indigenous societies, and that post-secondary institutions need to recognize and incorporate indigenous approaches in locales where those are prominent;

Three respondents noted a wide disparity between the cultures of post-secondary institutions as places of academic preparation and as places of professional pursuit.

Three stated that as members of the Academy who teach, they feel obligated to address issues they see arise in their classrooms and laboratories;

Three others related that critical times in people’s lives must be taken into consideration when evaluating performance or attributing credit or blame for actions, especially those that account for transitions such as marrying, becoming parents, and/or providing family care for those in times of aging or illness;

One person stated that who one connects to along their professional and personal path is critical, and can result in different reactions at different times of life.

The Researcher’s Reflections on Interview Answers Vis-à-Vis Research Questions

This researcher’s career, over the course of the last 20 years, has focused entirely on improving the research infrastructure at her post-secondary institution. The University
of Hawai‘i at Hilo is a public, predominantly undergraduate institution that has been diligently striving to grow its research enterprise by offering carefully selected Master’s degrees that will enable its faculty to continue to hone their own research skills while also imbuing their curriculum with rigorous, relevant research for their students. This author has been part of and often guided the efforts to add research equipment, create and sustain a nationally recognized Master of Science program in Tropical Biology and Environmental Science (MS TCBES); include our island’s cultural practices and ways of learning and knowing; create, outfit, and upgrade laboratories that both enable in depth research for our faculty and allow them to inculcate it within the fabric of their coursework at all levels; and recruit and retain both students and faculty from under-represented demographic groups – ethnic, geographic, gender-based, and socio-economic.

When deciding on the methodology of her dissertation, the writer found that the phenomenological approach was best suited to examining the questions. It was also the method that fit best with the culture from which she was approaching her Dissertation in Practice. Hawai‘i is largely an oral culture, wherein people share wisdom, humor, news, and points of view via word of mouth. The term for this method of communication in Hawai‘i is called “talking story.” The methodology of asking a group of people to share their stories was therefore the ideal way of teasing out the answers to the two research questions.

**Question #1: Pertaining to Risk Tolerance.** After analyzing the answers to the interview questions, and on reflection of not only those answers but also the background materials used to structure this dissertation, the researcher came to understand that the
idea of risk tolerance is such an individual one that it is most likely impossible to assign
categories of it to one demographic group or another. Rather, it seemed to be something
that might only be viewed by trying to look at a subject’s perception of their behaviors
and choices through their own lens.

There were three major lenses that presented themselves during the course of
these interviews: gender was one, and the main one by which respondents were sorted;
age and time in the Academy was another – and perhaps coincidentally one that revealed
differences in respondents’ perceptions of the risks and challenges of their careers. Race
or ethnicity was the third lens that colored people’s perceptions.

Gender proved to have almost no influence on why the respondents chose to
pursue science as a career. Virtually all the respondents, men and women, indicated they
chose to pursue science because they had a drive to explore the question of “why.” There
was no particular aspect of “why” that they wanted to pursue, but each and every one of
them wanted to be able to figure out something that they had noticed happening in life.

Where the researcher began to notice a marked difference in people’s approaches
to their career paths and how they managed their challenges – and indeed, how they
accepted or built upon their successes – was with their ages. Those who were advanced in
their careers recognized that there was a difference in how women would be perceived
and treated. They stated that women were largely missing from their role models during
their post-secondary educations, and that they were almost entirely absent from the
faculty rosters of their STEM courses. The ones who chose to pursue STEM faculty
positions did so knowing they would be “odd men out,” as it were, but did so anyway
because of their overriding curiosity.
This group also spoke extensively about the importance of their spouses during their careers, especially early on. One Dean who had left his position as administrator to return to his faculty position went so far as to insist, “Put that in, put that in,” after he stated his wife had enabled him to pursue his career with the focus needed to succeed. Three respondents related the clerical staff at their institutions, who in their memories were all women, had and continue to exert a huge influence on the success or failure of faculty members’ work. This group was the only one that recognized the importance of support from staff. These remarks were not split out along gender lines, but were universal within this age group.

Respondents who cited racial or ethnic discrimination, as opposed to gender-based, were consistently in the mid-range of faculty members’ career paths. The group was small – consisting of three – but their remarks were nearly identical. One told the tale of her competitor for an Executive Director position at a science- and culture-based museum in terms of her interview process being much more extensive and rigorous than his. It turned out that the competitor was Caucasian while she was not. Another man stated the discrimination he noted was most definitely not based on gender but rather on race – again, the difference being that this person was non-Caucasian.

The “flip side” of these race and ethnicity differences was that, particularly in the mature to advanced ranges of respondents, the men noted they had very distinct feelings of what they termed reverse discrimination – they felt their positions as men (especially those who were Caucasian) put them at a disadvantage, which they resented. Conversely, the eldest interviewee, who was well into his 80s, indicated that as a white man he had never felt a single iota of discrimination against him during his entire career.
After considering these many different layers and lenses through which the interviewees responded, the researcher began to perceive that the question of why people pursue a STEM faculty position is not something that is attributable to the person’s gender. The drive to enter academe was driven more by curiosity than anything else. A secondary drive was the one to impart one’s learning to those coming along behind one, but even that was subsumed by the innate curiosity of the scientific mind.

**Question #2: Pertaining to Factors Contributing to Retention and Success.**

As to how differences between men and women affect their retention and success in those faculty positions, again this seemed to be so individually driven as to be unable to be addressed along gender lines. Rather, the importance of a collegial atmosphere, support from the institution’s administration for both research and educational missions, and the ability to carve out enough time to pursue their individual agendas were the driving factors in how STEM faculty members would stay at an institution or seek another one to work at. In some cases, the faculty members would leave the Academy entirely – but the most vocal one among the researcher’s respondents eventually found her way back, and to the same location from which she had left.

**Overview of Results by Question**

The answer to the first research question, “Is there a difference in women and men’s risk tolerance that leads them to stay in or leave from their positions more readily?” were inconclusive. Risk tolerance was such an individual characteristic that it was likely not addressable by gender or by any other single demographic classification. How can we attribute such a quality by gender when that aspect of each person is also tied to one’s age, culture, physical abilities, or even one’s health status?
With respect to the second research question, “How do differences between men and women in STEM faculty positions affect the retention and success of women in those positions?” the author noted that differences among individuals was what determined their success or failure in whatever endeavor they pursued. This researcher is a woman and approaching retirement, and yet was always of the opinion that she could do whatever she put her mind to. This was because her father, who had been born and raised in rural Alabama during the Great Depression and whose own father had been a card-carrying member of the Ku Klux Klan always told her so. In fact, the one statement that she remembers most from him was, “You don’t have to let being a girl get in your way – you’re a beautiful, talented, articulate woman and you can do whatever you put your mind to as long as you put in the work.”

Perhaps what we need to do is make it possible for our faculty to do their work – inform them of the policies at their specific institution that will have a direct effect on their tenure and promotion and what their various avenues of approach might be during periods of transition and challenges, provide them with laboratories where they can inquire and teach, give them the support staff to enable them to use their creativity instead of spending hours each week trying to figure out how to fill out purchase orders or submit time sheets, and make sure their supplies are in stock when they need them. Above all, we need to provide faculty with a safe place to be who they are.

Summary

In this chapter, the researcher presented findings of her interviews regarding the two research questions: 1) Is there a difference in women’s and men’s risk tolerance that leads them to stay in or leave from their positions more readily? 2) How do differences
between men and women in STEM faculty positions affect the retention and success of women in those positions?

Responses to the first interview question proved inconclusive with respect to whether women or men have a higher level of risk tolerance when choosing their career paths in academe as STEM faculty. Rather, the answers revealed a level of similarity that was both unexpected and refreshing: faculty seemed to be driven by their curiosity and to a certain extent by a wish to affect change in either the natural world or the lives of their students. Their perception of risk did not seem to be a factor in their career path choice.

With regard to the second question, responses revealed that there are certain needs on the part of faculty in academe, particularly those in research-based STEM disciplines, that should be addressed in order to ensure or at least improve the chances for their persistence and success. The researcher will present solutions that will hopefully address those needs in Chapter Five.
CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

Introduction

The Dissertation in Practice under consideration has examined two related questions regarding STEM faculty members at post-secondary educational institutions in the U. S.: one relating to possible risk tolerance and tolerance differences between men and women who pursue such faculty positions, and another asking how best to ensure equity among recruitment, retention, and eventual promotion of both genders.

Post-secondary faculty in STEM disciplines in the U. S. is skewed toward men (National Science Board, 2018), leaving the impression that women either do not, cannot, or perhaps should not pursue careers in these fields. This is a great disservice to girls and young women, and consequently to the intellectual and economic potential of our nation. It is critical for our post-secondary faculty to accurately represent our population in demographic terms: not only with regard to ethnic backgrounds, but also those of gender and even (to the extent possible) to people with disabilities and those with differing sexual orientation. Such consistency in representation is important because the nation’s vigorous innovation depends on a robust pipeline of well-educated and highly motivated critical thinkers who will continue to contribute to the economic engine that innovation drives (National Science Board, 2015).

In this study, the writer examined trends in faculty demographic composition at universities in the U. S. – and in particular at the one in which she has served her academic career for the past 20 years – with a specific eye toward learning why women in STEM disciplines seem to leave at higher rates than men (Xu, 2008). She will offer a proposed solution in this chapter to the issue of uneven representation, retention, and
promotion of women in and from STEM disciplines within the Academy in the U. S. by offering a solution that can be carried out at her home institution. This proposed solution will be one that will be replicable at other, similar institutions. Results of the implementation of the proposed solution can be published in peer reviewed journals, and through the NSF Programs the researcher has worked with and referred to throughout this dissertation. The proposed solution will discuss implications for its implementation from practical, research, and leadership viewpoints, and will present a conclusion for the dissertation.

**Purpose of the Study**

The purpose of this qualitative Dissertation in Practice study was to determine if differences in perceptions between men and women in STEM faculty positions may affect the retention and success of women in those positions.

Universities have engaged in a variety of activities designed to increase recruitment and retention of women in STEM disciplines, especially since the 1990s (National Science Board, 2015). These efforts have had some limited success, but women still tend to leave their positions in STEM disciplines at universities at a higher rate than do men (National Science Board, 2018). Xu (2008) indicated that women’s levels of commitment to their fields of study are as firm as those of men in the same fields, yet they still leave their positions more readily than men. That study further suggested the cultural considerations women encounter may be a driving force behind their tendencies to leave positions more readily. The author of this Dissertation in Practice posits that women who enter men-dominated STEM faculty positions already exhibit a higher tolerance for risk simply by entering a profession in which they are in a notable minority,
and which is known to present its members with a very inflexible set of policies and expectations (Valentino, Moller, Stearns, & Mickelson, 2015).

**Aim of the Study**

The aim of this Dissertation in Practice was to determine whether women who pursue STEM faculty positions have different perceptions of their professional settings than men who pursue the same career paths. Demonstrating such a difference in how women and men perceive their careers as STEM faculty may result in tailored recruiting and/or retention strategies that would yield a more equitable level of representation of women in STEM fields alongside men.

**Proposed Solution**

The solution this author proposes, based on results of the study, to address perceived inequities in STEM faculty positions and how they are pursued involves implementing a concentrated effort on the part of her university to create a supportive training and professional development structure so faculty can go about their teaching and research with the knowledge that their administration supports their contributions to the university’s mission. This will be accomplished through the establishment and implementation of two related sets of activities: 1) leadership training and professional development activities that target both incoming or new faculty, and training that bolsters research, teaching, and administrative skills and continues to raise the consciousness of those who have been with the university for a longer period of time; and 2) hosting of a Women in STEM Conference annually that encourages women’s participation in STEM fields, as well as honors those whose contributions to their fields have enabled and/or
enriched them. Both of these sets of activities are proposed to be housed administratively within the Women and Genders Studies program.

**Activity 1: Leadership Training and Professional Development Activities**

The first set of recommended activities includes a multi-step training for faculty. Introductory training will inform all new or assistant professor level faculty on gender, race and ethnic discrimination, and sexual harassment policies, as well as the tenure and promotion policies that exist within the institution. Coordinators of this activity will work with the Equal Employment Opportunity (EEO) Office to produce hard copy and online informational materials on gender, race and ethnic discrimination, sexual harassment, and tenure and promotion policies to be made available to the new faculty. An EEO officer will lead two New Faculty Brown Bag Lunch sessions per semester to discuss these issues so that new faculty know the avenues for support and assistance if they experience bias or discrimination, and also that they may be properly informed about their professional advancement opportunities and obligations.

Activity coordinators will seek input from the EEO office and UH Professional Assembly (faculty union) to train mid-career and senior faculty in hiring and promotion and changes in academic career trajectories and policies regarding gender, sexual orientation, ability, ethnicity, and race. Two such training sessions are proposed to be held per semester. All items discussed and any remarks made during sessions will be kept anonymous.

Based on findings revealed during the training sessions above, coordinators will prepare an annual report for senior campus administrators to facilitate their review of gender-based issues on campus. This will inform administrators of the need for or
efficacy of policy changes especially with respect to tenure and promotion. All findings will be reported anonymously.

**Activity 2: Annual Women in STEM Conference**

The Women and Gender Studies Program at UH Hilo is a major within the College of Arts and Sciences. This researcher proposes that each year, funding be allocated that will support an annual Women in STEM Conference open to faculty, staff, students, and the general public. The Conference will feature a keynote speaker and panel discussions about women’s careers and the issues they come across, especially as regards solutions they have devised to challenges.

Support should allow for up to $3,000 in travel expenses for the keynote speaker and possibly one other speaker for this conference who can address the scientific disciplines under consideration and to gender-based issues. This funding is envisioned to be enough for up to two speakers who are experts in gender, race/ethnicity, and abilities bias in STEM and in the academy, as well as in any of the TCBES-supported disciplines. An additional allocation of up to $2,000 per year for conference expenses including refreshments and expendable materials would be provided.

**Support for the Solution**

The findings about risk tolerance and perception revealed a distinct lack of differences based on gender. A person’s predilection to remain in or depart from a challenging faculty position is not necessarily affected by that person’s gender, based on this study’s findings. Further, Xu (2008) indicated that women’s levels of commitment to their fields of study are as firm as those of men in the same fields, yet they still leave their positions more readily than men. That study further suggested the cultural considerations
women encounter may be a driving force behind their tendencies to leave positions more readily.

Respondents to this study revealed that the culture or locale of one’s institution had a major impact on the levels of challenges encountered. Nine respondents discussed this, with several alluding to the indigenous culture of Hawai‘i being a major consideration with regard to teaching and research methods. Four related that the difference between indigenous and “Western” ways of learning and knowing created a challenge to their teaching and research.

A further consideration that faculty revealed stood in the way of their successful pursuit of their careers was that university careers are notoriously family-unfriendly. Seven respondents, both men and women, related this as part of the climate or culture of their institution. This plays a very important part when faculty members are planning or experiencing transitional periods in their families – having children or caring for sick family members and the like.

All these aspects of an academician’s professional life must be addressed. Making the training sessions available for early career faculty that will inform them of their options for such considerations is critical to their empowerment and ability to plan for challenges as they arise. These sessions will necessarily be made available to all faculty, even though the issues addressed were discovered in a gender-based study. In this way, the education of the full spectrum of faculty will be improved.

The researcher believes this type of training will be a consciousness-raising process that will result in a more completely informed body of faculty across the university. The findings of these training sessions, which will be presented to senior
administrators, can also become the nexus of publications and possibly the basis for extramural funding for further study. NSF ADVANCE in particular requires such self-study to be conducted prior to applying for funding to initiate institutional transformation projects. These training sessions and their reported results will be well suited as preliminary data.

**Factors and Stakeholders Related to the Solution**

The primary group of stakeholders related to this proposed solution is comprised of the faculty of UH Hilo. Additional stakeholders include, but are not necessarily limited to, support staff, administration, and other campuses within the state-wide university system of campuses. Students are a stakeholder group that stands to be significantly impacted by the proposed solution as well.

**Policies Influenced/Influencing the Proposed Solution**

The main policy that needs to be addressed in order to implement this proposed solution is that of allocation of funds to departments. Each academic year, the allocation of funds at UH Hilo is accomplished through an internal, competitive process. If the administration were to earmark funds for a specific conference, that would likely cause some conflict among the general faculty population. Explaining the benefit across the faculty would likely ameliorate that conflict, so the “roll out” of the commitment of institutional funds would be important in order to provide buy-in from as many constituents as possible.

**Potential Barriers and Obstacles to Proposed Solution**

The University of Hawai‘i is a unionized workplace. As such, each and every policy and/or practice is embedded within the contracts of the various units: faculty,
auxiliary departments such as custodial workers and other facilities workers, athletics, and even to the extent that unions dictate how they will interact with executive and managerial workers, those non-union personnel have their roles and responsibilities strictly laid out. Therefore, any changes to established ways of doing things, such as the institution of a new training program or the dedicated institutional funding of an annual conference, is subject to union actions if any grievances are filed.

**Financial/Budget Issues Related to Proposed Solution**

This researcher estimates that the funding required for the training sessions will be minimal. The financial consideration is less of a burden than the one based in the time required to conduct the sessions and compile annual reports. For the training sessions, the largest financial consideration would be that of preparing the handouts. Posting these documents online will be the best way to keep them current, since updating online documents is a simple matter. As stated previously, for the annual Women in STEM conference, the researcher proposes a budget not to exceed $5,000. She anticipates that if the costs do exceed the amount of funding set aside from university funds, the organizers will undertake to propose for the overage from extramural sources – whether local or national.

**Legal Issues Related to Proposed Solution**

As stated earlier, the main legal implication this proposed solution carries with it pertains to the strict unionization of the UH System. The researcher is confident that the shared mission of those at the University will allow them to come together as they witness the transparency of the activities and their potential benefit to the whole campus. The Aloha Spirit is alive at UH Hilo.
Other Issues or Stakeholders Related to Proposed Solution

University of Hawai‘i at Hilo exists within the confines of the city of Hilo, Hawai‘i, on the island of Hawai‘i, also known as the Big Island. The population of the entire island is approximately 43,000 of the 1.3 million residing in the state as of 2010, which is the most recent official count available from the U. S. Census (U. S. Census Bureau, 2020). That population is spread over an area of approximately 53,000 square miles. While it may seem that a population of over 43,000 people is substantial, this researcher’s spouse is a retired police officer whose one and only prisoner control method was the posing of a single question, “Who’s your father?” This invariably resulted in his knowing who said father was, where he lived, and what kind of car he drove (personal communication, H. Chong, 1982—2010). The population on this island is very tightly connected. Therefore, as programs are implemented at the local branch of the University, their impacts are felt quickly and deeply. It is essential that any programs enacted are done so with great thoughtfulness toward the local culture and population. This is particularly important when considering the indigenous ways of learning and knowing that will be discussed during the faculty training sessions.

Change Theory

University of Hawai‘i at Hilo has been engaged in the Design Thinking process as relates to its own model for affecting change within its own organizational framework since 2011. This researcher is a member of the Design Thinking Hawai‘i group and is a certified coach in the process. This method of looking at, planning, and implementing change is a highly iterative one that allows for continual evaluation and adjustment to the
processes under consideration. As such, it is fitting to include this method of change within the adaptive leadership framework cited earlier by this researcher.

**Implementation of the Proposed Solution**

The researcher proposes both activities be administratively housed within the Gender and Women’s Studies program, which in turn is housed within the College of Arts and Sciences. The department will work closely with the EEO office, and the faculty union will also be consulted as sessions are developed and findings are reported.

**Factors and Stakeholders Related to the Implementation of the Solution**

The main stakeholders related to implementing this proposed solution are the faculty of University of Hawai‘i at Hilo. University administration is another set of stakeholders in this process. Students likewise have a stake in this proposed solution, since they are the “end users” of the faculty’s teaching, research, and community service. The general public should also be taken into consideration, particularly parents and family of current and prospective students and members of the local business community who stand to be likely employers of graduates of UH Hilo.

**Leader’s Role in Implementing Proposed Solution**

University of Hawai‘i at Hilo has a relatively new Chancellor, which is this campus’s title for its CEO. Dr. Bonnie Irwin has been at the campus since July 2019, and is in the process of completing her first year of service. Irwin is the person who will be responsible for approving the adoption of this solution. Since her assumption of the role of Chancellor, she has engaged in a months-long series of meetings with the various departments during which she has gone to them, listening to their concerns and expressing her views on issues they bring up. She repeatedly states during these meetings
that she is a fierce supporter of her faculty (personal communication, B. Irwin, March 30, 2020). This process is exactly what the adaptive leadership process embodies.

**Building Support for The Proposed Solution**

Dr. Irwin is still in her first year, and is engaged in searches for senior administrators in the roles of Vice Chancellor for Academic Affairs (which oversees the research endeavor directly) and two Dean positions: one for the College of Arts and Sciences and one for the College of Natural and Health Sciences. The researcher is confident the administrative support is there for this proposed solution, but does realize that the continued period of leadership fragility poses a distinct challenge. Engaging faculty widely with developing these proposed training sessions and the proposed annual conference will provide Chancellor Irwin with a strong record of transparency in regard to how she pursues initiatives. This will, in turn, allow her to build a basis of trust among her faculty and staff.

**Additional Considerations for Implementation and Assessment**

Assessment is the true test of the success of any initiative’s implementation. As such, the researcher proposes that the two sets of activities include expected outcomes and evaluation metrics for measuring their success.

**Expected Outcomes for Activity 1**

There will be brochures available both in print and online that outline policies that deal with discriminatory behaviors and sexual or other workplace harassment. The EEO policies in hiring, as well as departmental policies regarding tenure and promotion will likewise be available online. Four new faculty Brown Bag Lunch sessions per year will be offered – two per semester – during which attendees will be provided with orientation
specific to UH Hilo’s policies and procedures. Four workshops targeting advanced assistant professors and higher will be offered to provide leadership training and to ensure more advanced faculty are aware of and comply with human resources guidelines and regulations. An annual informational report that provides an overview of findings revealed during these sessions will be made to Vice Chancellors for Academic Affairs, Students, and Administrative Affairs, as well as the Chancellor. All information will be reported in the aggregate, with no personally identifying information provided.

**Evaluation Metric to Measure Success for Activity 1**

Each in-person session will gather attendee numbers and questionnaire-based input on its informativeness and suggestions for improvement. Personal identifiers will not be gathered.

**Expected Outcomes for Activity 2**

The annual Women in STEM conference will be presented at UH Hilo, featuring two guest speakers per year. This conference will be open to all interested parties, free of charge, and will include light refreshments in order to allow attendees to remain engaged throughout the day. A questionnaire on the quality and effectiveness of the conference will be distributed to attendees, with a clear statement that answers will remain anonymous.

**Evaluation Metric to Measure Success for Activity 2**

An annual informational report that provides the number of participants and a disaggregated analysis of their responses to the questionnaire will be made to Vice Chancellors for Academic Affairs, Students, and Administrative Affairs, as well as the Chancellor.
Global/External Implications for the Organization

UH Hilo is an important part of the educational and cultural climate of not only this island but the overall Pacific Basin. Many of the students who attend this campus come from across the Pacific, with 11% of UH Hilo students citing their permanent home addresses at either foreign or U. S. related areas (UH Institutional Research Office, 2020). As such, the global implications for this proposed solution to improve the retention and promotion of faculty are important in the campus’s relationship with the many island nations that entrust their students to its care and education.

Evaluation and Timeline for Implementation and Assessment

Implementation of this proposed solution can begin at any time but would be best timed for beginning at the beginning of an academic year. Due to the recent pandemic caused by the COVID-19 virus, the academic year of 2019-2020 has been severely interrupted. Therefore, the researcher anticipates that implementation will likely have to wait until at least the following academic year of 2020-2021.

Implications

Practical Implications

This study examined existing data to compile reasons women leave their faculty positions at this higher rate than men. The proposer recruited a pool of interviewees to explore if and how tolerance for and perception of risk are deciding factors in women choosing to leave or men choosing to stay. This information had the potential to result in changes to policy, especially those dealing with tenure and promotion, at STEM departments in universities where the interviews were conducted, which might in turn have resulted in broader policy changes across university cultures. University policies (or
lack thereof) about family leave, tenure clock pause/stoppage, burdens of committee membership, among others have often been cited as impediments to broader representation by women (Marschke, 2007). These policy changes had the potential to encourage more women to stay in their faculty roles, possibly increasing representation in their fields – which in turn could encourage more women to enter those fields in the future.

The proposed solution is one that will include women and men at the campus where the researcher works. This is the only way that disparities between men and women will be successfully addressed. Singling out one demographic group to benefit from such fundamental training automatically disenfranchises all others, thereby causing any benefit to be abrogated. Therefore, the proposed activities will be widely available.

**Implications for Future Research**

This researcher did not find a significant difference between the men and women who agree to be interviewed for this Dissertation in Practice as pertained to their risk tolerance. She recognizes that perhaps there was not enough depth to her questioning to reveal such potential differences. It may therefore be a possible area for future research, using a more comprehensive approach to investigating that single aspect of STEM faculty at post-secondary institutions in the U.S.

**Implications for Leadership Theory and Practice**

The leadership model put forward by this researcher was that of Adaptive Leadership (Adaptive Leadership, 2017). She also referred to the change methodology of Design Thinking as an effective way of initiating and affecting change within a university setting (IDEO, 2020). Both models involve a high degree of iteration – the approach of
continually assessing results and looking for ways to improve them. This continues to be, to this researcher’s mind, the most effective way to keep a university, with its many disciplines of study and its many levels of governance, current and relevant in its organization.

The issues of gender-based risk tolerance and decision making have been studied for decades. While the questions have remained the same, revolving around trying to find out why women leave their STEM faculty positions at a higher rate than their colleagues who were men, the population under consideration has undergone a great deal of change. During this researcher’s adulthood, which now spans 46 years (from age 18 till now), many fundamental changes have occurred directly relating to how women govern their own lives.

Women entering the professional workforce in the U. S. now have never known a time when they could not apply for a loan on their own, without being married and having the approval of their husbands to do so. Likewise, they have always been able to apply for and use a credit card on their own. These two fundamental rights were not available to women in the U. S. until the 1970s (Department of Justice, 2019). For that matter, until the late 1960s, it was legal in the U. S. to discriminate against women during the recruitment and hiring process, as well as to pay them less for the same jobs as men despite equal qualifications (Department of Justice, 2019).

Women (and for that matter, men) in the workforce who have grown up with the protections offered by the Equal Pay Act (NOLO, 2020) and Equal Credit Opportunity Act (Department of Justice, 2019), among other legislative and societal changes, have no frame of reference for the inequities women have faced and continue to face. One
question that comes to mind is whether this is a good thing or not: is it perhaps better that women pursuing careers nowadays approach them with the mindset that they have the right to equal consideration? This might be another study that could be conducted.

**Summary of the Study**

This study sought to investigate the differences in rates of retention for STEM faculty members at post-secondary educational institutions in the U. S. between women and men. In particular, the researcher hypothesized that women who pursued these positions within the Academy did so knowing they would be in the minority in a field that was known for rigidity of tenure and promotion policies, and that they would therefore exhibit higher degrees of professional risk tolerance than their counterparts who were men. She also sought to determine what if anything might be done to ensure a higher rate of retention and promotion on the part of women in STEM faculty positions, to bring them into a closer state of parity with men.

Differences in risk tolerance or risk aversion were not specifically revealed as a result of the interviews the researcher conducted. Further study is indicated, perhaps with a dedicated focus instead of being coupled with another question. The researcher found that faculty at her institution would benefit from training for incoming faculty to prepare them for their career paths and empower them with knowledge about their tenure and promotion policies. She further found that faculty farther along in their careers would benefit from professional development in leadership so they would be effective in their roles as mentors to their younger colleagues. She proposed that an annual conference for Women in STEM would allow rising stars in these disciplines to be featured and would provide a venue through which faculty and other researchers could network.
References


https://www.ideou.com/pages/design-thinking


Retrieved from StratEGIC Toolkit: Strategies for effecting gender equity and institutional change: www.strategictoolkit.org


Appendix A: Example of email invitation to participate in interview process.

I am writing to invite you to participate in an interview by telephone concerning the disparity between attrition rates from STEM faculty positions for men and women. You were invited to participate in this interview process because of your association with an institution funded under the <insert name of NSF program here: ADVANCE, EPSCoR, other as applicable>.

By participating in this interview, you will become a member of a group of interviewees from whom information regarding risk tolerance will be derived, for purposes of my own Dissertation in Practice via Creighton University. Your responses will be recorded and transcribed for inclusion with other responses from other participants. Audio files from any interviews will be destroyed upon transcription. Data from the interviews will be analyzed and responses will be reported in the aggregate. In the event of comments used, they will be paraphrased statements to assure anonymity. No personal identifying information will be included in this dissertation. Institutional Review Board approval is available upon request from this researcher.

Please respond to tchongdip@gmail.com by use of the online opt-in form by <providing a two-week window> if you are interested in participating in this interview process, or if you have any questions about it.

Sincerely,

Signature block information referring to Creighton University student status
Appendix B: Interview Protocol

Interviewer: Terrilani Chong

Interviewee: <Enter name of participant here>

Position of Interviewee:

Introductory remarks:

Thank you for agreeing to be interviewed for this Dissertation in Practice on “Perceptions of Women vs. Men in STEM Faculty.” I want to remind you that your comments will remain confidential and anonymous, and that your participation is voluntary.

You can take a break at any time during this interview and can discontinue it if you so desire.

Please feel free to ask me any questions you might have any time they occur to you.

Questions:

1. What was it about your specific scientific discipline that made you want to pursue it?

2. Who have your mentors been and how have they influenced your career choices? Have your mentors been primarily men or women?

3. What differences have you noticed in how men and women provide counseling or mentoring?

4. As you’ve progressed in your career in academe, what challenges have you noted that
seemed more pointed because of your gender? How have you dealt with those challenges?

5. Do you feel that you have enough time to pursue your research and other scholarly activities?

6. Describe your idea of a perfect academic position – including the recruitment and startup, and all the collateral obligations such as advising students, pursuing research, and interacting with members of the community for outreach and other purposes.

7. How did your recruitment and interview process with your current institution compare with your “perfect” image of one?

8. Please describe how your current position is either fulfilling or failing your expectations for the above position? How might you go about achieving your goals with respect to your professional aspirations?

9. Please feel free to talk about any topics you feel I may have left out that are important to you in regard to this subject.

***********

Demographic and institutional profile data on interviewee:

Gender:
Ethnic identity, choose one:

Hispanic
Non Hispanic
Do not wish to declare

Race, choose all that apply:

American Indian or Alaska Native
Asian
Black or African American
Native Hawaiian or Other Pacific Islander
White
Other: please specify

Highest degree attained:

Date:

Area of Study:

Current faculty rank and discipline:

Length of time in position:

Length of time at institution:

Institutional Profile, choose all that apply:

Primarily undergraduate four-year post-secondary institution
Research-intensive post-secondary institution
Community College
Other two-year post-secondary institution
Minority Serving Institution
Historically Black College/University
Tribal College/University
Hispanic Serving Institution

Native Hawaiian Serving Institution
Appendix C: Informed Consent

Agreement to Participate in

PERCEPTIONS OF WOMEN VS. MEN IN STEM FACULTY Interview

Terrilani Chong, Doctoral Candidate, Creighton University

Participation in this interview is based on your response to the email invitation to do so, sent by the above named researcher on <insert date here>, in support of said researcher’s Dissertation in Practice for Creighton University’s Ed. D. in Interdisciplinary Leadership.

Participation will consist of interview by telephone or other virtual method. You will be asked about your experiences as a STEM discipline faculty member at a post-secondary educational institution. Data from the interview will be summarized and sorted into broad categories.

Paraphrased statements if used will be modified to assure anonymity. No personal identifying information will be included with the dissertation. Approximately 20 faculty will participate in the interview process.

This researcher believes there is little or no risk to participating in this interview. However, there may be a small risk that you will experience psychological discomfort when discussing some of your experiences. You are free to stop at any time.

Participating in this interview may be of no direct benefit to you. The researcher believes, however, the results from this interview and its ultimate inclusion in the dissertation will help to shed light on why women in STEM faculty positions seem to leave them at higher rates than men in the same or similar ones.
All interview data will be confidential. Interviewees will be coded using a random number generator and personal identification is never connected with the data. Agencies with oversight, such as the Creighton University Institutional Review Board, have the authority to review anonymous evaluation data.

Interviews will be audio recorded for the purpose of transcription, and the recordings will be destroyed upon transcription. Transcripts will be kept in a password protected electronic file until the dissertation is submitted and the doctoral degree process is completed. Upon completion of the doctoral process, all transcripts will be deleted electronically and any hard copies will be shredded.

Participation in this interview is completely voluntary. You are free to withdraw from participation at any time during the duration of the evaluation with no penalty.

If you have any questions regarding this process, please contact the researcher at tchongdip@gmail.com.

If you have any questions regarding your rights as an interview participant, please contact the Creighton University Institutional Review Board: IRB@creighton.edu.
Appendix D: Creighton University Institutional Review Board Exempt Status

DATE: February 1, 2019

TO: Terrilani Chong
FROM: Creighton University IRB-02 Social Behavioral

PROJECT TITLE: [1379121-1] RISK TOLERANCE OF WOMEN IN STEM FACULTY
SUBMISSION TYPE: New Project
ACTION: DETERMINATION OF EXEMPT STATUS
DECISION DATE: February 1, 2019
REVIEW CATEGORY: Exemption category # 2

Thank you for your submission of New Project materials for this project. The following items were reviewed in this submission:

- Application Form - 402 Application for Determination of Exempt Status Observation, Survey, Interview 12102018.pdf (UPDATED: 01/18/2019)
- Creighton - IRB Application Form - Creighton - IRB Application Form (UPDATED: 01/18/2019)
- Protocol - DIP_Proposal_TChong_01312019.pdf (UPDATED: 01/31/2019)

This project has been determined to be exempt from Federal Policy for Protection of Human Subjects as per 45CFR46.101 (b) 2.

All protocol amendments and changes are to be submitted to the IRB and may not be implemented until approved by the IRB. Please use the modification form when submitting changes.

If you have any questions, please contact Christine Scheuring at 402-280-3364 or christinescheuring@creighton.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Creighton University IRB-02 Social Behavior's records.