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Fernandes, Frank J. *The Underrepresentation of Hmong-Americans in STEM Careers*

Abstract

Hmong-American students were underrepresented in Science, Technology, Engineering, and Mathematics (STEM) programs at one technical college within the Wisconsin Technical College System (WTCS). This qualitative study employed a narrative inquiry and set out to understand the factors that influenced four Hmong-Americans to pursue their STEM careers. This inquiry generated rich descriptive data from the participants who were meaningfully employed in STEM fields at the time of the study. After the interviews were transcribed, a thematic analysis was conducted using Lichtman's (2013) Three C's of data analysis. Four overarching concepts and twelve categories (themes) emerged from the analysis. The concepts that emerged were: (1) Parental influences on academic success, (2) Career actualization, (3) Support systems, and (4) Overcoming challenges and barriers. College attendance was encouraged by their parents as a means for social mobility, but parents did not influence their choice of STEM career. Career actualization in STEM was triggered at a young age by exposure to various experiences. Both financial support as well as support provided by various institutional agents was critical in allowing them to pursue a STEM career. Participants were made aware of their minority status and at times faced subtle racial invalidations. Implications and recommendations based on these findings are discussed.

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Chapter I: Introduction

For the United States to stay competitive in a global economy, it is imperative to increase the number of graduates in the Science, Technology, Engineering, and Mathematics (STEM) fields. A 2012 report published by the President's Council of Advisors in STEM emphasized that the number of STEM graduates needed to increase by 34 percent compared to current rates to satisfy the demands of the STEM professional workforce (President's Council of Advisors on Science and Technology, 2012). The deficiency of graduates with STEM majors persists, even though research has shown that STEM majors earn substantially more than other college degrees with the exception perhaps of business (Arcidiacono, 2004; Arcidiacono, Aucejo, & Hotz, 2016). The deficiency is even more profound when one includes Hmong-Americans into the mix. This study investigated why Hmong students pursued careers in STEM fields within a technical college district in central Wisconsin.

What is STEM?

The acronym STEM, and the STEM movement has gained impetus in the recent years. It evolved from the need to strengthen science, technology, engineering, and mathematics education in the United States. STEM was emphasized in reports from multiple agencies in the 1980's, such as the National Commission on Excellence in Education (1983); the National Science Foundation (NSF) and the U.S. Department of Education (1980; as cited in Briener, Harkness, Johnson & Koehler, 2012). The acronym STEM was introduced in 2001 by Judith A. Ramaley, a former director of the NSF's Education and Human Resources Division (Snyder, 2018). NSF defines STEM fields broadly, including not only the disciplines of mathematics, natural sciences, engineering, and computer and information sciences, but also some social/behavioral sciences such as psychology, economics, sociology, and political science

(Green, 2007). In conducting a qualitative study on full-time faculty members at the University of Cincinnati (UC), Breiner et al. (2012) concluded that there was no common operational definition or conceptualization of STEM. Faculty members viewed STEM from how it impacted them in their daily lives. Most faculty members in this study viewed STEM as it was related to individual STEM disciplines, validating the notion that the disciplines exist as silos, while other faculty members discussed the integrated nature of STEM. Additionally, Angier (2010) explained that in a poll conducted on five thousand participants by the Entertainment Industries Council, eighty-six percent of the participants did not understand the reference. Many confused it with STEM cells, while others confused it with flowers and broccoli stems. Angier (2010) goes on to state that “Everybody who knows what it means, knows what it means, and everybody else doesn’t.” Looking at STEM from a lens of outcomes of K-16 education, most stakeholders would agree that STEM is an integrated approach to educate better students, teachers, and a workforce so that the United States can compete globally (Breiner et.al, 2012).

Minorities and STEM

Despite various efforts by governmental agencies to increase participation in STEM fields, the enrollments and graduation rates show a deficiency in meeting that goal. In addition, even though there is diversification in the United States population, STEM majors and careers are seen as stubbornly male and white (Finkel, 2016). Underrepresented Minorities (URM’s) and people of color when added to this mix earn even fewer degrees in STEM than their majority peers (Byars-Winston, Estrada, & Howard, 2008; Calabrese Barton & Tan, 2018; Museus & Liverman, 2010). In most studies, URM’s are comprised of Black, Latina/o, Native American, and Southeast Asian Americans. Museus & Liverman (2010) explain that while Black and Latina/o students begin college interested in STEM majors at rates equal to or higher than their

white peers, they were approximately twenty-four percent less likely than white students to earn a bachelor's degree in STEM fields in six years. The rate of earning a STEM degree is even more unlikely when Southeast Asian students are added to this mix (Hune 2002; Museus, 2013). Seymour & Hewitt (2000) explain that as of the year 2000, the National Science Foundation (NSF) has spent more than \$1.5 billion to increase the participation of minorities in the sciences, and the National Institute of Health (NIH) has invested \$675 million for the same initiative. Why these racial disparities exist in STEM field graduates is a research topic that is of utmost importance.

Hmong-Americans are a minority group that falls under this URM category. State-wide enrollment data from all the sixteen technical colleges in Wisconsin (Appendix A), as well the enrollment data (Appendix B), albeit aggregated under the Asian category, shows that proportionately the number of Hmong students enrolled in Science, Technology, Engineering, and Mathematics (STEM) programs has not kept pace with an increase in the Hmong population as a whole in this rural Midwestern region being researched. The issue of underrepresentation of Hmong in STEM fields has persisted for the past thirty years. The thirty-year underrepresentation of Hmong students was further validated by a Hmong Counselor at the technical college with the researcher in casual conversation (H. Lee, personal communication, October 20, 2017). Although the technical college in this study has made numerous efforts such as offering pre-college camps in the summers for Hmong students, the college has not succeeded in recruiting these students into STEM programs. Recent immigrant students bring rich social, linguistic, and cultural resources into our classrooms, but educators from traditional U.S backgrounds are not prepared to deal with the diverse practices or lived experiences these underrepresented students bring to the classroom (Upadhyay, 2009).

A Brief History of the Hmong

In her book “Tragic Mountains: The Hmong, the Americans, and the secret wars for Laos, 1942 – 1992,” Hamilton-Merritt (1993) tells the story of the Hmong people and their struggles. The Hmong were originally from China and had a fiercely independent culture dating back to 2000 B.C. They subsequently migrated south to the mountains of Laos, Thailand, and Vietnam. The Hmong were America’s staunchest allies in the Vietnam War and were recruited by the Central Intelligence Agency (CIA) to be the foot soldiers against the North Vietnamese. They gave up everything to fight besides the Americans in the Vietnam War, but were abandoned by the United States when it withdrew in 1975. During this period, the Hmong were subject to genocide by the communist Laos and Vietnam and even had chemical-biological agents used on them. They were forced to flee to refugee camps like Ban Vinay in Thailand by crossing the treacherous Mekong River, anxiously hoping to be granted refugee status to come to the US.

As refugees, most of the Hmong immigrants did not have a formal education. Their education in the refugee camps of Thailand and Laos can be described as non-existent (Upadhyay, 2009). If the children in the refugee camps were fortunate, they were educated solely for literacy purposes (Upadhyay, 2009). Thao (2009) explains that initially the refugees were sponsored by many voluntary agencies, such as the United States Catholic Conference, Lutheran Social Services, and others. These sponsoring agencies recruited local churches and individuals to be immediate sponsors for these refugees. However, these sponsoring agencies were only responsible to help the refugees for a short period of time. It was then that the refugees turned to their relatives and clan members for help (Thao, 2009, p. 9). In addition, relocation programs in the U.S provided for literacy and/or vocational training opportunities for adults, but these adults

lacked formal schooling (Lee & Hawkins, 2008). It was during this period that adult literacy programs were being offered by some Wisconsin Technical Colleges that had sizeable Hmong refugee populations. At first, the Hmong were being taught English in the churches that sponsored them, but they were later brought over to the technical colleges so that they could experience the American educational system. The deliberate intention was to create pathways for these English Language Learners (ELL) to pursue one of the programs at the college and for them to find meaningful employment. Even with efforts like this, the adult Hmong refugees could only find low paying jobs because they lacked college degrees or a formal education (Upadhyay, 2009).

Generational Diversity

It is also worth emphasizing that not all Hmong students enrolling or enrolled in the US educational system today are refugees. Museus and Mueller (2018) explain that, while a substantial portion migrated thirty years ago, many were born in the United States. The Hmong college student population is characterized by a generational diversity. Hmong students who entered the U.S. as adults were characterized as first-generation refugees. This first-generation of Hmong entered the United States as refugees from Laos in 1975 (S. Lee, 2001). However, Rumbaut and Ima (1988) define a group that had gone totally unnamed in the literature, termed as the “*1.5x generation*.” This group is neither a part of the first-generation of their parents nor are they part of the second-generation of students who were born in the United States. Asher (2011) describes Generation 1.5x as young people who live in immigrant households, who speak a language other than English at home. Their first language is not English. They attend American schools and have been socially acculturated in the US. They exhibit a lack of academic fluency in English because of their non-English speaking backgrounds at home and in

their home communities. In addition, they tend to lack the fluency of the language of their parents because they have not been immersed in it academically (Asher, 2011).

Hmong students navigate the US high school system differently based on this generational diversity. S. Lee (2001) conducted an ethnographic study on Hmong students enrolled in a preparatory high school in Wisconsin and noted how they navigated the U.S. high system differently. She explains that some teachers categorize Hmong students, albeit diplomatically, based on their generational diversity. They refer to the 1.5x group as the English as a Second Language (ESL) students and the “second generation” students as the “Americanized” students. The ESL students are the newcomers, and they still keep and value Hmong traditions (S. Lee, 2001). A teacher in S. Lee’s study in explaining how both these two groups had different relationships to schooling and in trying to explain the possible cause of truancy states “We don’t have problems with those ESL kids.....they are not Americanized.....they are hardworking and trying to graduate” (p. 509).

S. Lee (2001) in her study points to the negative impact Americanization has on student achievement. Even the Hmong students from both groups in her study, the 1.5x and the second-generation, admitted to these generational differences, and their social boundaries never crossed. They both belonged to different clubs at the high school. The 1.5x generation belonged to the all-encompassing Asian club while the second-generation Hmong students belonged to the Hmong club. The second-generation ridiculed the 1.5x generation for being too traditional and for how they dressed. They used derogatory terms like FOBS (Fresh Off the Boat) or FOBIES to describe the 1.5x Hmong students. Even at lunchtime, both groups preferred sitting separately, the 1.5x with the other Asian foreign students, while the second-generation Hmong students clustered

among themselves. However, despite these generational differences, S. Lee (2001) emphasized that both groups were proud of being Hmong.

Hmong and Educational Achievement

Research on the Hmong started in the late eighties. More recently researchers have explored the complex nature of Hmong students' educational experiences and how forces inside and outside school affect Hmong students attitudes towards education (Iannarelli, 2013; Iannarelli, 2014; S. Lee, 2001; Lor, 2008; Museus, 2013; Thao, 2003; Yang, 2017). Iannarelli (2013) examined factors affecting the academic performance of Hmong students at a Wisconsin technical college similar in size to the one used in this study. In her research, data revealed significant disparities in the grade point averages (GPA) of Hmong and white students. By disaggregating the Hmong students from the Asian population, she was able to acquire data from 91 Hmong students, 60 of whom were female and 31 were male. The cumulative GPA for white students was higher than the Hmong students. Further, there existed influences of gender of Hmong educational attainment. Although, the white female students' GPA was higher than the Hmong female students' GPA, the Hmong female students outperformed their male counterparts. This outperformance is consistent with the fact that Hmong-American college women are undergoing a cultural transformation that encourages school persistence (S. J. Lee, 1997).

Downing, Olney, Mason, and Hendricks (1984) showed an elevated dropout rate for females compared to males in the Minneapolis-St Paul area. In a study performed on Hmong girls in Wisconsin, Goldstein (1985) explained that Hmong girls dropped out because of cultural traditions, hence winning community and family approval by moving into gender roles. Also, researchers like Rumbaut and Ima (1988) asserted that this high female dropout rate was

connected to the patrilineal and patriarchal norms that tend to devalue females among the Hmong.

Further complicating the issue of Hmong educational success is the intergenerational conflict that exists between second-generation Hmong youth and their immigrant parents. Thao's (2003) study on Hmong students reveals that Hmong students experience significant cultural clashes both at home and at school that negatively affect their performance in school. A study conducted by Lor (2008) on Hmong graduates from the four-year university system in this Midwestern state posits that five clusters of key life experiences contribute to Hmong students' matriculation for college. The clusters were (1) Supportive family (2) Social and academic support (3) Life Lessons (4) Vision and drive for success and (5) Financial support. Findings from another study, conducted by Museus (2013) on Southeast Asian students at four-year institutions revealed the complex and multifaceted ways in which parental influences shaped and guided the educational trajectories of Southeast Asians.

A study conducted by Yang (2017) on cohorts of Hmong men in engineering and computer sciences (ECS) at California State University (CSU) showed that Hmong males who entered engineering at CSU had the lowest persistence rates of all other groups. This low persistence according to Yang (2017) was because Hmong men in engineering were implicitly excluded from support programs at the university and their struggles were not being recognized. Most Hmong men in this study were first-generation college students and were from the lowest rung of the Socio-Economic Status (SES).

Statement of the Problem

An issue complicating studies on educational achievement gaps for Hmong and other Southeast Asian students is a perceived myth that exists. Iannarelli (2013) explains that the

Hmong are incorrectly categorized as the “*model minority*.” The term “*model minority*” was coined in the mid-sixties during the Civil Rights movement, and according to Chang (1993), it first appeared in an article published by U.S News and World Report about the 300,000 Chinese-Americans and how hardworking they were compared to the rest of the minorities. The report went on to say that in the Chinatowns from New York to Los Angeles, this racial minority was pulling itself up from hardship and discrimination to become a model of self-respect and achievement in America. This model minority myth and the encapsulation of the Hmong within an all-encompassing Asian grouping obscures the extensive heterogeneity within this panethnic group (Iannarelli, 2013). Thus, more research is needed specifically on Hmong-American students and why they are not enrolling into STEM programs.

Calabrese Barton and Tan (2018) explain that, for marginalized groups, there are no pathways into STEM, and gaining access into STEM disciplines is an uphill battle. Although the Hmong are classified by the aggregated grouping of Asian Americans, these enrollment numbers are still drastically low. Lor (2008) expounds that overall only 11.7 percent of the Hmong population had an associate or bachelor’s degree when contrasted to 21.9 percent of the U.S. population. These numbers showed an even greater disparity when broken down into the individual STEM disciplines. This underrepresentation in STEM was also noticeable in other minority groups. For example, Burt and Johnson (2018) in analyzing Black students in STEM, albeit at the graduate level, found similar results. Yoder (2017) noted that in the United States in 2015, only 2.5 percent of the engineering professoriate, 3.2 percent of the engineering doctorate recipients, and 1.6 percent of those enrolled in doctoral programs were Black. Burt and Johnson (2018) emphasize that increasing the numbers of underrepresented who complete advanced

degrees in STEM will not only solve a national problem, but it will also build a sound infrastructure and provide models of success for future generations.

In the northcentral region of the state, technical college data (Appendix A) as well as career cluster data for Racial and Ethnic Minority (REM) students from Iannarelli's (2017) study confirm that minority students are underrepresented in STEM fields (p.63). If the Hmong were disaggregated from the all-encompassing Asian grouping, the underrepresentation in STEM careers would be more profound.

Purpose of the Study

Data from the U.S. Census Bureau (2010) denotes that the Hmong people are a sizeable minority in the Midwestern city in this study. Regional estimates in the year 2015 indicate that 4891 persons, comprising of 12.5%, were Asian out of a total population of 39,210. Also, state-wide Technical College data shows that proportionately, the number of Hmong students enrolled in Science, Technology, Engineering and Mathematics (STEM) programs has not kept pace with an increase in the Hmong population as a whole. Of 922 total students enrolled in STEM programs in the year 2017, only 43 were Asian, comprising 4.6% at the technical college in this study. This underrepresentation of Hmong students in STEM programs has existed for the last thirty years and continues to persist.

Data obtained from the Department of Public Instruction (DPI) database WISEdash (2020) for the two public high schools serving this Midwestern city shows identical characteristics to the state's technical college data. Out of 8,104 total students in this PK-12 school district, 1575, or 19.4% were Asian. As of 2018, 2467 total students were enrolled in both public high schools, of which 400 were Asian. There were 463 total students enrolled in Career and Technical Education (CTE) pathways, of which 40 were Asian, 8.6%. This Department of

Public Instruction data suggests that Asians were not enrolling the STEM educational pathways in the two high schools in this Midwestern city in Wisconsin.

Asians were also underrepresented in STEM careers upon graduation. State-wide data from the United States Equal Opportunity Commission (2019) on job patterns for professionals, technicians and mid-level office managers in manufacturing in private industry for whites and Asians demonstrated an incongruence in Wisconsin (Appendix C). The data shows a significant downward spiral in the count of both the Asian as well as the white groups represented in manufacturing careers from 2007 to 2015. This underrepresentation of Asians in STEM education as well as STEM careers lend credence to Finkel's (2016) assertion that "STEM fields are stubbornly dominated by whites and males."

The purpose of this grounded theory research study was to uncover what influenced a group of Hmong professionals to pursue STEM careers. Through the data provided by participants who have experienced the process and from coding that data, cross-cutting themes will be unveiled. Creswell and Poth (2018) explain that the intent of a grounded theory study is to move beyond descriptions and to generate or discover a theory, a "*unified theoretical explanation*" for a process or an action. By conducting research with successful Hmong professionals in the STEM fields, this study could paint a better picture as to the causes of this underrepresentation. This study will look at what factors led to the successes of these Hmong professionals in STEM. By performing a thematic analysis, common themes will be unveiled. Implications from this study's findings should not only inform but also help broaden participation for future Hmong students in the high demand STEM fields.

Research Questions

The primary focus of this study is to answer the overarching question: What factors have influenced Hmong-Americans who are currently engaged in STEM related careers to pursue STEM careers? Specifically, the following questions will be answered:

- (a) What role do family and the community play in influencing Hmong-Americans to pursue STEM education?
- (b) What role do family and the community play in influencing Hmong-Americans to pursue STEM careers?
- (c) What role do educational institutions play in influencing Hmong-Americans to pursue STEM education?
- (d) What are the economic factors involved with Hmong-Americans to pursue a STEM education and career?

Answering the above questions should achieve the goal of this study, which is to unveil what is causing the underrepresentation of Hmong-Americans in STEM careers.

Significance of the Study

In much of the literature, the Hmong are studied under the “Asian” panethnic group. Hence their specific educational successes or lack thereof has been obscured. They have been stereotyped by the popular press as hardworking and high-achieving model minorities on the one hand, but on the other hand, they are depicted as low achieving high school dropouts involved in gangs (Ngo & Lee, 2007). Hence, the realities of the educational success of Hmong-Americans is far more complex than each of these images suggest. Iannarelli’s (2013) study revealed significant disparities between Hmong and white students in educational success and attributes this to socio-economic status. However, no research has been conducted as to what influenced the Hmong-Americans to enroll in STEM career pathways.

Another concept that could potentially play a role in this study is to ponder if the Hmong-Americans are being “Othered” by our American educational system, which is undergirded on white Eurocentric values. If this is the case, then schools in the U.S. for underrepresented minorities (URM’s) like the Hmong could become “contradictory social sites” where their values, beliefs, cultures, and languages are contested and marginalized. Ladson-Billings (1995) in discussing teaching and culture posits that the first step in “culturally responsive teaching” is to bridge the gap between home and school for underrepresented minorities; by discovering small differences in social relations, it will make a big difference in which (minority) children engage in school (p. 467). Although there is a significant body of literature on Hmong student success or failure, there is no research done as to why an underrepresentation in STEM careers persists.

Assumptions of the Study

This is a qualitative study; hence, in seeking a deeper understanding of Hmong underrepresentation in STEM, an assumption will be that the research participants offer multiple realities that are socially constructed. Most importantly, the participants will be expected to answer the questions honestly and provide rich descriptions of their situations through their “*lived experiences.*”

Another assumption is that the Hmong population as a whole has unique cultural influences and experiences that could influence their underrepresentation in STEM fields as compared to other marginalized communities. Hmong students, both 1.5x (arrived in the U.S as children) and second-generation Hmong-Americans, experience our educational system differently (S. Lee, 2001). The 1.5x Hmong-Americans and second-generation Hmong-Americans might have different cultural negotiations with their respective families. Also, based

on the generation gap, these two groups of Hmong students might experience educational outcomes differently. The 1.5x generation tends to have better educational outcomes than the second and third generations since they see the U.S. as being a land of opportunity. This assumption could be extrapolated to most immigrants.

Limitations of the Study

This study, being qualitative as opposed to a quantitative study, will have different meanings when issues of reliability, validity and researcher bias are addressed. In a qualitative study, reliability is achieved through consistency in data collection and analysis techniques. The issue of external validity, which is the ability to generalize findings to a wider population, is not the researcher's main objective here. Most important is the desire to gain a deeper understanding of the situation from participants "*lived experiences*."

Another area of concern might be the fact that the researcher himself is employed in a STEM field. The close proximity to the researcher's interest and the area of study might be a concern to some. However, one can argue that experience that the researcher has in this STEM area could provide for richer descriptions of the participants lived experiences.

The fact that the researcher himself is a first-generation immigrant in a STEM field might garner some concern to some. By incorporating a strict protocol during the data collection and analysis process, this should help quell some of the fears. By being a first-generation immigrant, the researcher might be able to develop a high level of trust between the participants and himself, thus providing for meaningful descriptions of the experiences.

The scope of this research study will be within one technical college and its surrounding district within central Wisconsin. Therefore, the findings of this research may not generalizable or extrapolated to larger populations.

Definition of Terms

The following are the definitions of terms used throughout this paper that may not be familiar to readers.

Asian. A person with origins from the Far East, Southeast Asia, or the Indian sub-continent, including, for example, Cambodia, China, India, Indonesia, Japan, Korea, Malaysia, Pakistan, Philippines, Thailand, and Vietnam (United States Census Bureau, 2010).

Educational attainment. The highest level of education that an individual has completed (United States Census Bureau, 2010).

Educational success. Successful graduation or completion of an educational program, or, for current students, the likelihood of doing so as represented by grade point average (GPA) and other indicators.

Hmong Americans. Belonging to an ethnically tribal minority group of people who lived in mountain villages in southern China and adjacent areas of Vietnam, Laos and Thailand. The Hmong were America's staunchest allies in the Vietnam War and were recruited by the CIA to be the foot soldiers against the North Vietnamese. The Hmong gave up everything to fight besides the Americans in the Vietnam War. Many of these people emigrated to the United States, following the Vietnam War (Hamilton-Merritt, 1993).

Hmong-American 1.5x. Hmong-Americans who came to the United States as children and are largely educated and socialized in the United States (Portes, 1996).

Othered. To reference groups of persons who are traditionally marginalized, denigrated or violated in society. These include persons of color, people from under or unemployed families, persons who are female, or male but not stereotypically "masculine," and persons who

are or who are perceived to be queer. They are often defined in opposition to the groups that are favored, normalized or privileged in society (Kumashiro, 2002).

Panethnicity. The erroneous grouping and communal labeling of various autonomously distinguishable and self-identified ethnicities into one aggregate group of people; this aggregation is found based on similarities in physical appearance, common language, or common religion (Iannarelli, 2013).

Southeast Asian Americans. People from a variety of Asian ethnicities from the countries of Vietnam, Laos, and Cambodia who came to the United States as refugees after the Vietnam War ended in 1975. They make up 15.2% of people reporting as Asian and/or Pacific Islander heritage (U.S Census Bureau, 2010).

Science, Technology, Engineering, and Mathematics (STEM). A term introduced in 2001 by Scientific Administrators at the National Science Foundation (NSF). It is viewed as an interdisciplinary approach to learning by doing where rigorous academic concepts are coupled to real-world problem-solving strategies.

Chapter II: Literature Review

Hmong-Americans are a sizeable minority in the Midwestern region of concern in this study. Hmong-American student enrollment in Science, Technology, Engineering, and Mathematics (STEM) programs has not kept pace with the increasing Hmong population. The primary focus of this study is to uncover why this underrepresentation in STEM is occurring. By conducting research on Hmong professionals in STEM fields, this study will answer the overarching question: What factors have influenced Hmong-Americans who are currently engaged in STEM-related careers to pursue STEM careers? Specifically, the following questions will be answered:

- (a) What role do family and the community play in influencing Hmong-Americans to pursue STEM education?
- (b) What role do family and the community play in influencing Hmong-Americans to pursue STEM careers?
- (c) What role do educational institutions play in influencing Hmong-Americans to pursue STEM education?
- (d) What are the economic factors involved with Hmong-Americans to pursue a STEM education and career?

Answering the above questions should achieve the goal of this study, which is to unveil what is causing this underrepresentation of Hmong-Americans in STEM careers.

The literature on Hmong-American student success is nested not only within the Southeast Asian student grouping but also under the larger panethnic “Asian” grouping. Although their educational successes and or lack thereof have been obscured by these groupings, this literature review will investigate their achievements and the influences, both cultural and

structural, that have led to their educational achievements and or lack thereof in the United States.

In explaining the STEM workforce shortage, Hagedorn and Purnamasari (2012) posit that the American policymakers, educators, and others are concerned that the workforce shortages in STEM will have a catastrophic impact on the United States economy. Moreover, shortages of STEM workers vary by geographic locale. STEM achievement is also not consistent across ethnic groups or between males and females (J. Lee, 2002). The “Asian” people are positioned problematically in this STEM shortage.

As presented in Chapter I, the model minority stereotype label has been assigned to “Asians” since the Civil Rights movement in the 1960s. Many scholars and researchers have written extensively about this myth, which resulted from the growing societal discontent for African Americans and people of color (Chang 1993; S. J. Lee, 1997; Museus 2013; Ngo & Lee, 2007; Osajima, 1987). The myth argues that if the Chinese-Americans in the Chinatowns all across America are able to make it on their own through hard-work and pulling themselves up from hardship and discrimination by their bootstraps to become the “model” of self-respect and achievement in America, then so can the African-Americans and people of color. Osajima (1987) explains that this discourse affirms the failure of African-Americans and people of color in society is due to a lack of industriousness and values, and it is not due to the fact that America is a fundamentally racist society.

Hmong-Americans are also positioned tenuously in this discourse. Since their arrival in the United States in 1975, on one hand, they are looked at as hardworking high achievers. On the other hand, they are positioned outside this discourse of success and depicted as high school dropouts, gangsters, and welfare dependents (Ngo, 2006). Um (2003) argues that these divergent

stereotypes can fuel contradictory assumptions that Hmong-Americans are simultaneously problem-free model minorities who do not require support or that they are deviants that do not deserve help. To gain a deeper understanding of Hmong student success or lack thereof, we have to move beyond these misleading stereotypes and shed light on how various cultural and structural forces have impacted their educational trajectories.

Conceptual Framework

Many researchers have studied minority student achievement from a cultural and structural perspective (Nasir & Hand, 2006; Ngo & Lee, 2007; Olneck 2003). These perspectives will serve as a framework for reviewing the literature on the underrepresentation of Hmong students in STEM careers. Although the literature on Hmong enrollment in STEM careers is scant, an effort will be made to uncover the knowledge that might reside in a larger body of literature for Southeast Asian students and students of color.

Nasir and Hand (2006) explain that culture plays a pivotal role in the social reproduction process and adds complexity to the analyses of class, race, and schooling. A theory that is often cited in the social reproduction process is Bourdieu's (1986) Social-Capital Theory. Bourdieu (1986) contends that social reproduction is not a direct process whereby individuals are channeled by society directly into jobs sorted by social class, but rather that such reproduction is mediated by culture. According to Bourdieu, individuals, by virtue of their ways of being and doing in which they were socialized, possess a particular kind of cultural and symbolic capital that is differentially valued by the broader society and its institutions. Utilizing this cultural capital perspective, some kinds of cultural capital associated with upper and middle-class culture tend to leverage success in school. In contrast, other kinds associated with the lower-class culture leads to school failure. Thus, school failure is created by societies through the

distribution of cultural capital and not by individual strengths and shortcomings (Nasir & Hand, 2006).

Bourdieu and Passeron (1977), in explaining cultural capital, assert that schools are organized to favor the norms, values, and knowledge of the white, middle-class society. For Southeast Asian students and students of color, these students' home cultures and the educational institutions they attend are in cultural incongruence, conflict, and dissonance, which ultimately hinders their success (Museus, 2013). Alternatively, some scholars avow that if educational environments incorporate curricula, programs, and practices that reflect, engage, and validate the cultural backgrounds of students of color, more positive educational outcomes result (Ladson-Billings, 1995; Museus, 2013; Museus & Mueller 2018).

Others have written that community, family, and parental cultural values can hinder students' educational success for students of color (Min, 2003; Zhou & Kim, 2006). Wilson (2012) argues that residential segregation and poverty have given rise to cultures that promote self-defeating behaviors, such as welfare dependence, drug addiction, and school failure. These scholars affirm that minority children growing up in such cultures tend to resist mainstream culture and norms, which hinders their educational success and social mobility (Museus, 2013).

In addition to cultural explanations, structural explanations may be employed to explain the educational outcomes of Southeast Asian students and students of color (Nasir & Hand, 2006; Ngo & Lee, 2007; Olneck, 2003; Zhou & Kim 2006). Ngo and Lee (2007) explain that, in contrast to cultural explanations, structural explanations focus on issues of class, race, and or the intersection of the two. Educational success for minority students is structured into institutional practices of the educational institutions they attend. Darling-Hammond's (2003) research highlights problems relating to unequal funding, access to good teaching, access to course and

curriculum, and tracking practices as major structural forces contributing to achievement disparities.

In addition to cultural capital, another concept of social capital can be valuable in understanding how educational institutions can promote student success for Southeast Asian students (Museus, 2013; Museus & Mueller, 2018). In defining social capital, Bourdieu (1986) writes:

Social capital is the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition – or in other words, to membership in a group – which provides each of its members with the backing of the collectivity-owned capital, a credential which entitles them to credit, in the various senses of the word. (p. 248-249)

Thus, for those who possess it, social capital provides students with access and opportunity in education. Coleman (1988) explains social capital is composed of social networks, resources, and a constant exchange of information. Parents of students who have access to these social networks, such as community members or friends who are teachers, are able to assist one another and help their children succeed in school. Middle-class families possess more of this social capital, while working-class families lack this social capital (Ngo & Lee, 2007). Thus, middle-class families are able to negotiate schooling for their children.

Funds of Knowledge

Some researchers have gone a step further by examining ways culture and structure influence minority student achievement. Gonzalez, Moll, and Amanti (2005) put forth a concept called “Funds of Knowledge,” which is based on the premise that people are competent and have knowledge, and their life experiences give them this knowledge. This concept of funds of

knowledge also refers to historical and cultural knowledge, strategies, resources, and treaties of a community or a household (Upadhyay, 2009). Upadhyay (2009) explains that, when students come to a classroom, they draw upon these skills, ideas, and experiences to understand and make sense of what they are learning. He goes on to explain that some Hmong students, from recent immigrant families, for example, try to understand the cause of disease through the relationships of communities, families, and the individual souls (Upadhyay, 2009; Fadiman, 1997). In keeping with this funds of knowledge concept, John Chang and Rosiek (2003) in their research, found that a female Hmong student could not comprehend how the cause of cancer could be related to cellular malfunction. They explain that the Hmong girl's funds of knowledge related disease to social and spiritual imbalance and not to biological science.

Valenzuela (1999) combined a cultural and structural analysis by examining institutional forces of "subtractive schooling" that failed to take into account the "funds of knowledge" of Mexican immigrant students. In her three-year ethnographic study on Mexican immigrant students, she argues that schools are structured in ways that subtract resources from youth, divesting them from their cultures, languages, and community-based identities. Valenzuela suggests that educators need to utilize an additive schooling model that is purposeful about establishing authentic caring relationships in their policies and educational practices. By taking underrepresented students' funds of knowledge into account and by utilizing culturally relevant pedagogies, educators can empower and engage students in their science classrooms (Upadhyay, 2009; Ladson-Billings, 1995)

Parental Influences

In understanding the influence parents might have on Hmong-American students' educational journeys, a historical perspective is valuable. The Hmong and the all-encompassing

Southeast Asian people came to the United States not as voluntary immigrants but as refugees who fled their countries of origin to escape political persecution from the communist Vietnam government after the Vietnam war (Portes, 1996). Most of these refugees lived in refugee camps before coming to the United States. Museus (2013) explains that in these camps, they faced life-threatening circumstances and traumatic experiences such as disease, starvation, rape, homicide, genocide, forced separation from other family members, and inhumane living conditions. He goes on to explain that, while these circumstances caused the refugees immense psychological and emotional pain, other researchers associated them with developing survival skills to overcome obstacles that they might have encountered while navigating the complex postsecondary educational system in the United States (Kiang, 2002, 2009).

Ngo and Lee (2007) explain that Hmong parents, like many other immigrant parents, face linguistic and cultural barriers in terms of their involvement with their children's education; Hmong parents view education to be the primary responsibility of the school system. In researching parent-teacher relationships at a Hmong charter school, Adler (2004) found that Hmong parents came to the conferences primarily concerned with their children's behavior and not their academic performance.

Upadhyay (2009), in describing the school context for his study in terms of teachers, Hmong students, and Hmong parents' writes:

Many Hmong parents at the school have limited formal education as well as limited English language proficiency. Their involvement in school is limited to volunteering to pick-up and drop off neighborhood kids at school. Many parents also believe that school and teachers were in a better position to make "good decisions" for their children's

education. This kind of trust for school and teachers is prevalent in Hmong parents.
(p. 221)

In contrast to this type of parenting, there exists a “Tiger Parenting” model, which is fueled by the “Model Minority” stereotype. Chua (2011) in the book “Battle of the Hymn Tiger Mother,” suggests that Chinese parents are superior because of their traditionally overly strict and uncompromising parenting styles that force their children to excel academically. Chua (2011) blames the popular press for reinforcing this overachieving Asian model minority stereotype as parents demonstrate this “Tiger Parenting” behavior. Chang (2011) explains that it is this type of overgeneralization of Asian Americans that can directly fuel misconceptions that all Asian American parents pressure their children to excel academically.

In doing a deeper dive into the review of the literature on parental influences, both positive as well as complications due to parental influences are revealed. Museus (2013) conducted a qualitative study on thirty-four Southeast Asian students, and his findings revealed five main themes: (1) Parental Expectations, (2) Parental Values of Education, (3) Parental Sacrifice, (4) Internalization of Parental Pressures and Intrinsic Motivation, and (5) Complications in Parental Influences. In terms of parental expectations, participants in Museus’ (2013) study stated that their parents had developed expectations for them to go to college from an early age; parents did not make going to college an option, but it was an expectation. As values of education go, parents instilled a belief in their children that the key to social mobility, success, and happiness was education (Museus, 2013). In terms of parental sacrifice, participants mentioned that they felt that they had to pay back for the sacrifices their parents made for them; they described that the parents were never given the opportunity to go to college, and the sacrifices their parents made had led them to feel a responsibility to succeed (Museus,

2013). Participants also discussed how they internalized parental influences and associated this internalization with an intrinsic motivation to succeed (Museus, 2013). Finally, participants described that parental pressures were complicated in three ways: (1) excessive parental pressures, (2) lower expectations for women than for men in some communities, and (3) students pressured into majors by their parents that were not a good fit for them (Museus, 2013). These findings highlight the cultural value of parental influences but did not examine the role of structural influences or the interaction between the two in shaping the trajectory of the Southeast Asian educational trajectories (Museus, 2013).

Supple, McCoy, and Wang (2010), in their study on Hmong-American students, discuss a variety of parental disciplinary and behavioral strategies that were employed to promote academic success. The participants described some of the parental behaviors as coercive and authoritative but also providing rewards for high achievement. Some respondents in the study reported that parents provided money and expensive gifts, such as laptop computers and cell phones, for getting good grades. Other behaviors cited in Supple et al.'s (2010) study by the Hmong-American students of their parents were verbal support and checking their homework. Although some parents yelled and threatened their children from being expelled from the household, children looked at this behavior as being positive, loving, and being supportive of their education (Supple et al., 2010).

Another theme that emerged in Supple et al.'s (2010) study was ethnic identification as a motivation to succeed. These high achieving Hmong students had internalized socialized messages from their parents regarding hard work and achievement. Wanting to achieve well for these students was a way to prove that the Hmong are "as good as anyone else" (Supple et al., 2010).

Respondents in this same study also stated that some of the peers not trying hard in school or not taking advantage of educational opportunities was due to lax parenting, and this resulted in the lack of motivation for students. Supple et al. (2010) explain that while many Hmong youths felt a strong sense of obligation and acknowledged their parents' sacrifices, there are many that do not do well in school. This failure, according to the respondents, was due to the failure of the parents not consistently emphasizing the importance of academic achievement (Supple et al., 2010).

A study conducted by Lor (2008) of 18 Hmong graduates from the 4-year university system in Wisconsin posits that five clusters of key life experiences contribute to Hmong students' matriculation for college. One of these clusters was a "supportive parental (family) environment." Parental support came in the form of encouragement, childcare, financial assistance, and spiritual and emotional healing. Encouragement included storytelling about life struggles in Laos and Thailand, emphasizing the importance of education, occasional drop-in visits and phone calls, and significant monetary gifts (Lor, 2008). Lor (2008) goes on to explain that, for participants who got married before or during college and had children, childcare became a challenge for these participants to stay on course. Childcare by their parents provided much relief. In terms of spiritual and emotional support, participants in Lor's (2008) study cited how their parents had become pillars and reminded them why they had journeyed to America, risking their lives so that their children would have better opportunities. To some participants, even their parents' death provided an inspiration for them to work and study harder. One participant in Lor's (2008) study said, "I think my father's spirit lived through me and helped me" (p. 41); another participant said, "My father's death made me mature a little faster.... that might be the reason I made it" (p.41).

Hmong parents also used siblings as competitors to challenge their children. Parents compared their children to other siblings who were successful in college or to those siblings who did not meet their expectations and hence dropped out of college (Lor, 2018). Participants in Lor's (2008) study, rather than being undermined by these comparisons, took it as a challenge to succeed. A Hmong girl in this study explains:

I want to do better than my brothers. One dropped out. One graduated but did not work in his field of study. My brothers got all the attention. As a girl, I didn't receive much attention. My parents thought as a girl, I didn't have a capacity to do what my brothers are capable of. (p. 41)

Participants in Lor's (2008) study realized the hardships their parents went through while in Laos but were also saddened to see how hard they have to work here upon coming to the United States. The participants did not want to go through what their parents experienced. The sense of hopelessness experienced by their parents both in terms of economic and academic success would only be overcome if they (the children) went to college. The children were their only hope and the children did not want to disappoint them (Lor, 2008).

Community Influences

Thao (2009) conducted an ethnographic study on fifty-two adolescents from three different waves of Hmong immigrants who ranged in age from 14 to 23 and were from eleven clans: Lee, Thao, Vang, Yang, Her, Kong, Chang, Vue, Xiong, Moua, and Kue in the Twin Cities of Minnesota. With regards to the Community, the common themes in all three waves of immigrants that emerged in Thao's (2009) study were: (1) Their relatives encouraged their education, (2) Hardships suffered by their relatives and community influenced their education, and (3) Success of a relative and the overall Hmong community influenced their education. The

participants in Thao's (2009) study shared that many after school and community programs contributed to their successful education; programs that were identified were Upward Bound, ESL, mentoring services, Mission Possible, Basic standard test preparation, summer program, community program, and college visits (p. 152).

There is also an inter-generational conflict that arises in terms of community support. Thao (2009) explains that the first-generation Hmong associated more with peers that recently emigrated from Thailand because of their common backgrounds and they supported one another. First-generation Hmong associated less with the second-generation because of their American accents and the way they dressed.

This generational conflict is also described in S. Lee's (2001) one-and-a-half-year ethnographic study of 1.5x and second-generation Hmong students at a public high school in a mid-size Wisconsin city. The social boundaries of these students seldom crossed. S. Lee (2001) explains that students in one group admitted to having cousins in the other group, but they maintained their distance. The 1.5x group of Hmong students were more likely to participate in the Asian club, which comprised of students from other Asian ethnic groups (Chinese, Tibetan, Vietnamese, and Hmong) while the second-generation Hmong students dominated the school's Hmong Club. When asked why this was so, the 1.5x generation said that they were interested in teaching others about their Hmong culture, while the second-generation who belonged to the Hmong club cared only about organizing parties and other social events.

S. Lee (2001) explains that many 1.5x generation Hmong students considered the ESL (now known as English-Language Learners) program as a safe place, and they were mostly all enrolled in it. The high school in S. Lee's (2001) study enrolled 2,023 students, out of which 29 percent were students of color. The high school offered guided courses to help students make

the transition from ESL to mainstream classes, and in addition, utilized bilingual resource specialists to assist students with tutoring and translations. The 1.5x students stated that they were more comfortable speaking out in their ESL classes than in their mainstream classes. The ESL classroom was seen as a safe space for the students in a large and intimidating school (S. Lee, 2001). Despite these efforts, the 1.5x students were not high achievers, with the majority passing their classes with average grades. School personnel in this study stated that a growing number of minority ESL students were falling into a pattern of chronic truancy. This truancy was also exhibited by the second-generation Hmong students in this study, albeit for different reasons.

Institutional Agent Influences

Institutional agents play a key role in providing social capital to Southeast Asian students that help them foster their educational success (Museus & Liverman, 2010; Museus & Neville, 2012; Museus & Mueller, 2018). Institutional agent or Institutional agents refer to college faculty, administrators, staff and peers. Key Institutional agents and key agents refer to faculty, administrators, staff or peers whom participants identified as having a positive impact on their success (Museus & Mueller, 2018). In a study conducted by Museus and Mueller (2018), on 34 Southeast Asian undergraduate students at five public four-year colleges and universities, four themes emerged that helped foster success of these students in terms of characteristics of institutional agents. Institutional agents: (1) shared common grounds with their students, (2) humanized the educational experience, (3) espoused proactive philosophies, and (4) served as role models by modeling a passion for learning and success. Participants in the Museus & Mueller (2018) study reported positive impacts from key institutional agents who shared their racial, ethnic, and cultural backgrounds. One participant in this study stated:

Most of my professors are Caucasians.... It is very difficult when you don't see a lot of people like you in the professor position. Sometimes, I don't want to go talk to a professor just because I feel they grew up different from me.... they have a different lifestyle.... I feel intimidated because I don't see a connection with them in terms of culture. (p. 200)

Findings in Museus and Mueller's (2018) study reveal how concepts of social capital, trust, and closure can serve as a framework to understand the impact institutional agents have on Southeast Asian students.

Also discussed in this study is that institutional agents that share similar backgrounds with Southeast Asian students are able to foster increased trust and closure in their mentoring relationships with these students. However, prior research from Museus (2013) suggests that educators who do not share the racial, ethnic, or cultural background of students can also have a positive impact on their students' success by taking the time to understand their backgrounds and experiences.

Iannarelli (2017) explains that there is a shortage of Racially Ethnic Minority (REM) educators in all levels of education. However, in the secondary school system, there is an overwhelming majority of white female teachers (Iannarelli, 2017). Some educators, by utilizing Culturally Relevant Pedagogies (CRP), have found unique ways to relate to REM students and their parents (Ladson-Billings, 1995). Culturally Relevant Pedagogy must meet three criteria: (1) ability to develop students academically, (2) willingness to nurture and support cultural competence, and (3) develop a sociopolitical or critical consciousness (Ladson-Billings, 1995). Ladson-Billings (1995) explains that this can be accomplished by helping (prospective) teachers understand the culture (both their own and others) and the ways it functions in education.

Zeichner (1993) explains that CRP should not be done by adding versions of multi-cultural education or human relations courses that serve to exoticize diverse learners by “othering” them, but CRP needs to problematize teaching and should encourage teachers to ask about the nature of the curriculum, student-teacher relations, schooling, and society.

Ladson-Billings (1995) questions if this CRP methodology is “idiosyncratic,” that only certain teachers can employ it in their teaching; she explains that all the eight exemplary teachers studied in her research on African-American student success possessed one commonality, a classroom practice grounded in that they believed in the educability of all students.

S. Lee (2001) and Thao’s (2009) research on Southeast Asian immigrant students suggests that non-minority teachers might single out Southeast Asian students and treat them as foreigners or apply the deviant label to them. In S. Lee’s (2001) study, second-generation Hmong students stated that their high school classes were boring, and they desired a curriculum that reflected their culture and history. A student, who was identified as a chronic truant in S. Lee’s (2001) study stated that she would welcome a class in Hmong culture, history, or language. A guidance counselor in this same study, in comparing Southeast Asian students to East Asian students, explained that the East Asian student might be number three in the class and going to Yale, but the Southeast Asians were not very motivated. S. Lee (2001) explains that what this counselor failed to recognize or address was the possibility that high school may or may not have been doing something to affect the underachievement of Hmong youth.

Another perspective of analyzing this underachievement for minorities and students of color is to look at it through a lens of “*microaggressions*.” Iannarelli (2017) explains that although racial institutional discrimination may have legally dissipated through our educational system, the presence of subtle prejudiced behaviors has not. Microaggressions (MA’s) are brief

and commonplace daily verbal, behavioral, or environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory, or negative.....slights or insults (Sue et al., 2007). One subtle behavior or microinsult that debases or minimizes an individual's racial heritage is assuming that all Asians are good at math and science (Ong, Burrow, Fuller-Rowell, Ja, & Sue, 2013).

Ong et al. (2013) performed a study on Microaggressions (MA's) on 152 Asian American college freshmen (87 males, 65 female) in Tomkins County, New York, in which 56.6 % of the participants identified as second-generation and 28.3% identified as 1.5x generation (born in Asia, and came to the United States as a child or adolescent). Approximately 78% of these participants reported some form of Microaggression within the two-week study period. The majority of the daily microaggressions reported by the participants had themes of "*alien in own land*" or "*exoticization/immascularity*" (Ong et al., 2013). Although Asian-Americans experience themes of "*alien in one's own country*," African-Americans are more likely to experience microaggressions themes of "*assumption of criminality*" (Sue et al., 2007).

A study conducted by Suárez-Orozco et al. (2015) on microaggressions in three community colleges was titled "Toxic Rain in Class." The authors explain that each Microaggression (MA) is a toxic raindrop over time on its victims' well-being falling corrosively into their learning environments. Suárez-Orozco et. al (2015) explain that MA's by definition are often unintentional but nonetheless create distinct discomfort for their victims. Educators, must reflect upon their statements, create classroom climates that do not foster MA's, and develop a strategy for addressing MA's when they occur in the classroom (Suárez-Orozco et al., 2015, p. 158).

Ong et al. (2018) explain that microaggressions go beyond interpersonal interactions. She defines “*Institutional microaggressions*” as marginalizing actions and inertia of the university that may be found within structures and practices that endorse a campus climate hostile to members of underrepresented groups. In the context of STEM underrepresentation, Ong et al. (2018) cite examples of departmental hallways decorated with only pictures of white male scientists, a shortage of women’s bathrooms in engineering buildings, hiring practices with built-in biases (like giving preference to candidates personally referred by white male faculty), and inaction against discrimination by those in power. In her study of 39 women of color in STEM fields, Ong et al.’s (2018) findings revealed that “*counterspaces*” (which are safe spaces that lie in the margins, outside of mainstream educational spaces occupied by non-traditional groups) counter the distractions many face because of their racial/ethnic and gendered identities. Moreover, they write that “counterspaces created closer to the dominant powers structure of STEM education have the potential to be spaces of interactive learning (for underrepresented students) that may ultimately contribute to innovative and transformative STEM ideas and perspectives, as well as interrupt the structures, norms of success, and privilege of the dominant culture of STEM.” (Ong et. al, 2018)

Socioeconomic Status Influences

Southeast Asian communities are different from other Asian communities. Asian communities comprising of Chinese, Japanese, Indian, and Korean Americans have immigrated to the United States since the 1800s while the Southeast Asian communities immigrated after the end of the Vietnam War in 1975 (Museus & Mueller, 2018). Southeast Asians came to the United States as refugees under duress with essentially no economic assets or well-devised plans for the future (Sakamoto & Woo, 2007). Southeast Asians have low socioeconomic statuses and

are disadvantages when compared to whites (Kao & Thompson, 2003; Sakamoto & Woo, 2007). Refugees tend to have lower socioeconomic statuses than immigrants who are admitted for their labor market skills (Sakamoto & Woo, 2007).

Sakamoto and Woo (2007) conducted a study on second-generation Southeast Asians by using Public Use Micro Data Sample (PUMS) from the 2000 U.S Census. They make clear that Cambodians, Hmong, and Laotians tend to be disadvantaged compared to whites in terms of socioeconomic status, but the Vietnamese were advantaged. The Vietnamese have higher wages and managerial/professional employment than whites primarily because the Vietnamese have more education. Conversely, the Cambodians, Hmong, and Laotians tend to have lower wages and less managerial/professional employment than whites because these groups have less education (Sakamoto & Woo, 2007). The researchers go on to explain that the Hmong “parental generation,” because of their very low educational attainment levels, may be the most disadvantaged group in America and that the second-generation Hmong has education attainment levels, at least on par with or greater than the African-Americans. The researchers conclude by saying that, given the significant levels of social mobility among all of these second-generation southeast Asians, their results refute the hypothesis that today’s second-generation will languish in poverty (Sakamoto & Woo, 2007).

Hmong participants in Lor’s (2008) study on “Key life experiences contributing to Hmong students’ matriculation” explained that they did not come from wealthy families. Their parents’ financial resources were not enough to put them through college as their parents did not have much formal education or high paying professions (Lor, 2008). In describing the hardships endured by their parents, one participant states:

I don't recall anything. What I know is from my parents. Came in 1978. Before that I can't remember. I was born in Laos. My parents traveled from Laos to Thailand.

Traveled with relatives. They had my sister and me. Baby cried, and luckily they did not feed us opium so that they stayed behind. Later on they caught up to the relatives. (Lor, 2008, p. 44)

Participants in the same study mentioned that financial aid allowed them to fully engage in their college experience. Participants expressed a deep appreciation for the benefits and support they received from federal and state programs of financial aid and public assistance. A participant in Lor's (2008) study in explaining financial assistance explained that he knew that the peoples' tax paying dollars were supporting his education and he was not going to disavow or waste these resources; he wanted to make sure that these resources were well invested, and hence he persevered and worked hard in college to make certain that he graduated. These findings provide clear evidence of the critical role financial aid has had on Hmong students' matriculation and graduation from college (Lor, 2008)

In an article titled "The Overlooked Minority: Asian Pacific American Students in Community Colleges," Lew, Chang, and Wang (2005) explain that the socioeconomic situations of students' families impair academic achievement. Their parents or family members expect students to work long hours, take care of siblings or children, begin full-time work immediately after high school, or (especially for women) get married and have children at a young age (Lew et al., 2005). Parents of these low socioeconomic students themselves have to work long hours and are not at home to provide emotional support or guidance; furthermore, these Asian Pacific American students (APA) are the first in their families to attend college and must figure out how to navigate the U.S. educational system on their own since their parents are unfamiliar with

institutional norms and expectations (Lew et al., 2005). The authors explain that it is due to these circumstances that the APA students need additional support and guidance from counselors and faculty members (Lew et al., 2005).

In addition, Museus (2013) explains that immigrant and refugee parents of Southeast Asians who are less acculturated, in attempting to raise the family's socioeconomic status, might tend to steer their children into fields in which Asian-American role models and networks already exist. He makes clear that given the economic struggles that these parents have and continue to face, it is not surprising that they want their children to enter majors that will maximize their likelihood of financial security, and Museus' findings suggest that some parents pressure students to enter majors that are financially lucrative and stable such as science and medicine (Museus, 2013). However, his findings also suggest that this poses grave risks for students who are unhappy with their majors and struggle with the choice of changing their majors and, moreover, justifying these changes to their parents.

Hmong-Americans and STEM careers

The Asian American population is one of the fastest-growing racial groups in higher education. Espiritu and Omi (2000) explain that as a racial category, this grouping is not fixed but a fluid umbrella-like grouping that has evolved over the past three decades because of dynamic and complex negotiations between state interests, panethnic demands and ethnic-specific challenges (p. 43). Educational attainment for Asian Americans is generally high, but national data is misleading (Hune, 2002). Hune (2002) elucidates that U.S. census data can be deceptive in conflating the human capital of Asian immigrants educated abroad with those schooled in the United States. Since most of this data is aggregated, Hune (2002) explains that

great care must be taken when interpreting this data. Such data homogenizes Asian Americans and conceals individual and group distinctions that require attention.

Hmong-Americans are a small subset of this large Asian American panethnic grouping in the United States. Wisconsin's Hmong population increased from 33,791 persons in 2000 to 47,127 persons in 2010, a 39% increase. In the year 2000, the Hmong population represented 0.6% of the Wisconsin population, and the proportion has increased to 0.8% in 2010 (Hmong Chart Book, 2010). Also, the Hmong population is the largest Asian ethnic group in Wisconsin, comprising 36% of all Asian persons, while the next largest Asian ethnic group, the Asian Indian, account for 18% of the Asian population (Hmong Chart Book, 2010). Marathon County, which is primarily the region under study, has the highest proportion of Hmong residents (5.3%) in comparison to all the other counties in Wisconsin (Fact Finder US Census, 2018). Also, overall the Hmong population lagged behind the Wisconsin population in measures of educational attainment (Hmong Chart Book, 2010). One quarter of the Wisconsin population has a Bachelor's degree or higher, compared to only 13% of the Hmong population (Hmong Chart Book, 2010).

The literature in terms of Hmong enrollment in STEM majors is scant. Most prior studies investigated Hmong-American student success and educational attainment and the factors that caused this success or lack thereof in comparison to White Students (Iannarelli, 2013; S. Lee, 2001). Newer studies have looked at institutional factors that contribute to student retention/persistence of racial/ethnic minority students in STEM programs (Museus, 2013; Yang 2017), which are described below.

Museus' (2013) study that dealt with high-performing institutions and their implications for studying underrepresented minority students in STEM, was performed on three GEMS

(Generating Ethnic Minority Student Success) institutions. These institutions were selected because they exhibited retention and graduation rates for URM's appreciably higher than their peer institutions. In Museus and Liverman's (2010) study, the participants' sample comprised of thirty-one Asian American, Black, and Latino/a students as well as thirty-four administrators and staff members who were familiar with the experiences of URM students on their three respective campuses. Data were acquired from individual, semi-structured, face-to-face interviews as well from a collection of documents. Their findings illustrate that all three GEMS institutions exhibited four cultural characteristics of institutional influences that support minority student persistence: (1) Elements of campus culture, (2) Holistic and Integrated support systems, (3) Engagement in educationally purposeful activities, and (4) Sense of belonging to campus communities (Museus & Liverman, 2010). Elements of campus culture comprised of strong networking values, a belief in humanizing education, a commitment to targeted support, and an assumed institutional responsibility (Museus & Liverman, 2010). Holistic and Integrated support included cultural centers, equal opportunity programs, mentoring programs, transition programs, academic support programs, intrusive advising/support, supplemental instruction and, first-year seminars (Museus & Liverman, 2010). Engagement in educationally purposeful activities encompassed Academic challenge, Active and collaborative learning, Enriching educational experiences, Student-faculty interactions, and Supportive environments (Museus & Liverman, 2010). These factors helped to foster minority student retention at all three GEMS institutions.

Yang (2017) conducted a study of eight cohorts of URM men in Engineering and Computer Science (ECS) programs at California State University (CSU) from which he too was a graduate. Based on his own personal experience and anecdotal evidence, Yang (2017) suggests

that Hmong men face built in discriminatory challenges and unrealistic expectations as they attempt to navigate and earn their ECS degrees. In studying the eight cohorts, he reported that 52.9% were first-generation college students, and 79.4% received the Pell Grant. His findings suggest that Hmong men do not have a significant participation gap, but they do have a significant persistence gap – worse than any other minority group. He reported that four out of five Hmong men would not matriculate in six years. Also, reported in his study was that incoming freshmen Hmong students had the lowest persistence rates in ECS, and females have the highest persistence rates, even higher than the Hmong males. Below is a graph that shows the relative Participation Vs. Persistence for Hmong men, URM men, Non-URM men, and Women in ECS.

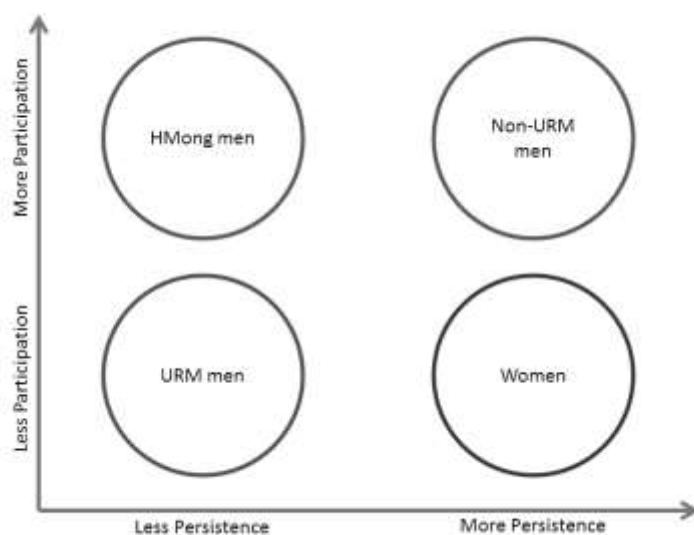


Figure 1. Relative comparison of participation vs. persistence for Hmong men in engineering. Adapted from “In the shadows of overrepresentation: Hmong men and Engineering education,” by C. Yang (2017), Unpublished Dissertation, p. 77.

Yang (2017) explains that Hmong men had better participation than women, but women were more persistent. Hmong men showed less persistence. Yang (2017) suggests that because

of where Hmong men placed on this graph, and the commonalities Hmong men shared with URM men, was due to the fact that they lacked the social and financial capital for success. Hence, Hmong men have unique experiences in engineering education compared to other populations.

Examining participation of Hmong Americans in the technical college in this study, state-wide technical college data (WTCS, 2020) shows that proportionately, the number of Hmong students enrolled in Science, Technology, Engineering and Mathematics (STEM) programs has not kept pace with an increase in the Hmong population as a whole in this rural Midwestern city being researched. Of 10,887 total students enrolled in STEM programs at the technical colleges in the year 2018, 535 were Asian, comprising 4.9% (see Appendix A). STEM programs comprise of manufacturing technologies, engineering technologies, and information technologies. Participation of Hmong high school students in Career, Technical, Education (CTE) courses shows similar results to the technical college data. Of the 463 total high school students enrolled in Career and Technical Education (CTE) pathways, 40 were Asian, 8.6% (WISEdash, 2020). Participation in STEM programs at the technical college in this study lags behind the growing demographic Asian (Hmong) population in the region being studied (see Appendix B).

In describing the workforce shortage in STEM fields, Hagedorn and Purnamasari (2012) explain that a labor shortage exists when the demand for a specific occupation exceeds the supply of willing, available and appropriately trained workers. The American workforce grew 150% from 1950 to 2000, while the STEM workforce grew 669% during the same period (Hagedorn & Purnamasari, 2012). The researchers go on to explain that the majority of STEM job growth will be in occupations requiring less than a Bachelor's degree; an Associate's degree

is all that is needed. In a documentary aired by Wisconsin Public Television in July 2011, over half of Wisconsin's state current jobs (54%) and almost half (46%) of its projected needs will be in middle-skill occupations requiring less than a Bachelor's degree (Hagedorn & Purnamasari, 2012). This data suggests that a shortage of STEM workers exists, and this could possibly impact the economy.

In state-wide data from the United States Equal Opportunity Commission (2019) on job patterns for professionals, technicians, and mid-level office managers in manufacturing in private industry for Whites and Asians demonstrate incongruence in Wisconsin (Appendix C). The data shows a significant downward spiral in the count of both the Asian as well as the white groups represented in manufacturing careers from 2007 to 2015. This underrepresentation of Asians in STEM education as well as STEM careers validates the fact that they are not pursuing STEM careers.

Summary

The literature review looks at the Hmong-American student underrepresentation in STEM careers from knowledge that resides in a larger body of literature for Southeast Asian students and students of color. The two perspectives that undergird minority student achievement or lack thereof are the cultural perspective and the structural perspective. Minority and low income students lack both cultural capital as well as social capital and this hinders their educational success.

Bourdieu (1977) asserts that educational institutions are organized to favor the norms, values, and knowledge of the white middle-class society. Researchers highlight that a pedagogy that takes into account the communication styles, norms, and knowledge of minority students, one that is culturally congruent will result in positive educational outcomes for minority students.

In addition, cultural values that emphasize the importance of education, parental sacrifices, and community influences explain the superior academic achievement among minorities (Ngo & Lee, 2007). Structural perspectives highlight the role of social capital, in which networks and resources help students navigate their educational trajectories. Institutional agents play a pivotal role in providing social capital to Southeast Asian students. Southeast Asian students have low socioeconomic statuses and are less affluent, hence, have less access to this social capital.

Hmong-American educational achievement data is nested in the all-encompassing Asian panethnic grouping and this grouping conceals their successes or lack thereof. Museus (2013) and Yang (2017) findings indicate that institutional factors contribute greatly to racial and ethnic student retention and persistence in STEM programs. Technical college data as well as high school data specific to this study shows that Hmong-American students are not enrolling into STEM and or CTE programs in comparison to the proportional rate of increase in the Hmong population as a whole. In addition, Wisconsin workforce data suggests that there is a significant shortage of Asians in Manufacturing/STEM careers. This validates the fact that Asians are not pursuing the STEM career pipeline starting from high school, through college and into the STEM workforce.

Chapter III: Methods and Procedures

The introduction to this research and the review of literature provides a foundation for the study that indicates a shortage of students pursuing careers in Science, Technology, Engineering, and Mathematics (STEM) fields. This shortage is exemplified when Underrepresented Minorities (URM's) especially Hmong-American students are taken into account. This shortage of students is of grave concern not only to Career Technical Education (CTE), but also to the United States economy. Hagedorn and Purnamasari (2012) explain that the two prevailing fears driving this fervor are: (1) the U.S could lose its dominant position in global innovation and technological expertise, and (2) there will be insufficient U.S citizens prepared to fill STEM-related jobs. The obscurity of Hmong-Americans in STEM-related fields presents a challenging situation in this discourse. As such, further research is needed to assist in understanding the problem. This study will answer the overarching question: What factors have influenced Hmong-Americans who are currently engaged in STEM-related careers to pursue STEM careers? Specifically, the following questions will be answered:

- (a) What role do family and the community play in influencing Hmong-Americans to pursue STEM education?
- (b) What role do family and the community play in influencing Hmong-Americans to pursue STEM careers?
- (c) What role do educational institutions play in influencing Hmong-Americans to pursue STEM education?
- (d) What are the economic factors involved with Hmong-Americans to pursue a STEM education and career?

Research Methodology

This study uses a qualitative approach to research the underrepresentation of Hmong-Americans in STEM careers. A qualitative methodology is suitable in this research study because there is no a priori hypothesis or theory to prove or disprove. This qualitative methodology will attempt to answer the overarching question: What factors have influenced Hmong-Americans who are currently engaged in STEM-related careers to pursue STEM careers?

Characteristics of Qualitative Inquiry

Creswell and Poth (2018) explain that qualitative research is conducted when there is a problem or issue that needs to be explored. This exploration is needed to study a group or population, identify variables that cannot be measured, or hear silenced voices. Creswell explains the characteristics of qualitative research as follows:

To begin with assumptions and the use of an interpretive/theoretical frameworks that inform the study of a research problem addressing the meaning individuals or groups ascribe to the problem. To study this problem, qualitative researchers use an emerging qualitative approach to inquiry, the collection of data in a natural setting sensitive to the people, and data analysis is both inductive and deductive and establishes patterns or themes. The final written report or presentation includes the voices of participants, the reflexivity of the researcher, a complex description and interpretation of the problem, and its contribution to the literature or a call for change. (2013, p. 44)

Thus, to answer the research questions of this study, a qualitative methodology was chosen. Participants of this study were empowered to share their stories, and by listening to their voices, and by minimizing the power relationships that often exist between researcher and

participants, it will uncover the factors that have influenced the Hmong-American participants that led them to pursue STEM careers.

Rationale for Using Qualitative Methods

In the review of literature, it was discovered that there seems to be a disproportionate number of studies that have utilized quantitative methods to analyze minority student success and persistence in both two-year and four-year educational institutions. In most of these quantitative studies, institutional data was analyzed for statistical significance on various constructs as it related to minority student achievement and or lack thereof. Institutional data from both the technical college in this study as well as the Wisconsin Technical College System data (Appendix A and B) showed that Asians are not enrolling in STEM programs. To seek an answer as to why they are not enrolling, a rationale as to why a qualitative inquiry is best suited to investigate this phenomenon is presented.

In Chapter II, a conceptual framework was incorporated in the review of literature rather than a theoretical framework. Since this study has no prior hypothesis or theory to prove or disprove, a conceptual framework was utilized that lays out the key factors, constructs, or variables, and presumes relationships among them (Grant & Osanloo, 2014). Since the outcomes to this inquiry were not known, and to gain a deeper understanding of why Hmong-American students were not enrolling in STEM programs, it was worth investigating the cultural and structural forces that were impacting their educational trajectories. A qualitative inquiry was deemed an appropriate methodology, and this inquiry would generate rich descriptive data from the participants who were meaningfully employed in STEM fields at the time of the study.

Some authors like Tracy (2013) use “the funnel metaphor” in illustrating the process of qualitative inquiry. According to Tracy (2013), like a funnel, qualitative inquiry usually begins

with a broad and wide-open research question, as that was the case in this study. This funnel analogy envisions the answer to the overarching question: what factors have influenced Hmong-Americans who are currently engaged in STEM-related careers to pursue STEM careers? Then by scouting the scene, collecting more data, and surely but slowly circling through the funnel, the focus is narrowed (Tracy, 2013). Through ongoing analysis and interpretation of this data, the research question(s) could potentially be answered.

Methodological Approach

To answer the research question, a combination of a narrative inquiry as well as a grounded theory approach was utilized. Creswell and Poth (2018) explain that a narrative research as a method begins with the experiences as expressed in lived and told stories of individuals. The focus of narrative inquiry not only valorizes individuals' experiences but also explores the social, cultural, familial, linguistic, and institutional narratives within which individuals' experiences were, and are, constituted, shaped, expressed, and enacted (Creswell & Poth, 2018). Utilizing this approach, the participants and the researcher engaged in a reflective process to interpret the meaning of the Hmong-American students' voices currently engaged in STEM careers and how these voices or viewpoints led them to pursue their individual STEM careers.

Grounded Theory was incorporated to maximize the flexibility of data collection and analysis. The intent of grounded theory is to move beyond description and to "generate or discover a theory," a "unified theoretical explanation" for a process or an action (Corbin & Strauss, 2014, p.107). All the participants involved in the study would have experienced the process, and the development of the theory might help explain practice or provide a framework for further research. Strauss & Corbin (1998) explain that this theory development does not

come “off the shelf” but rather is generated or “grounded” in data from the participants who have experienced the process. Data are collected through various methods of journaling, writing, photographs, audio and video recordings during direct interactions or observations of participants (Corbin & Strauss, 2014).

Subject Selection and Description

The participants for this study were comprised of Hmong individuals who had a connection to the Midwestern region where the technical college under study is located and were currently employed in STEM careers at the time of the study. This technical college serves a 10-county region, which is considered as rural. To find Hmong individuals to participate in this study, a purposeful sampling approach was utilized. Creswell and Poth (2018) explain that purposeful sampling is different from probability sampling, in that it does not require the researcher to determine statistical inferences to a population; rather, the intentional sample is a group of people who can best inform the researcher about the research problem under examination. The technical college in this study has a significant number of Hmong-American employees working in various areas of the college proportionate to the population demographics of this mid-size city, which was approximately 14%. However, there are no Hmong-American faculty members or senior administrative personnel employed in STEM fields at the college. Nevertheless, with the Hmong community being a tightly knit group, with the help of a few Hmong staff members, the researcher was able to find relatives of theirs who grew up in this community and who work in STEM fields across the state of Wisconsin and who were willing to participate in this research. In addition, the researcher was able to access an individual professional network that was willing to participate. This intentional sampling technique was intended to provide for reliable qualitative data.

The researcher applied for Institutional Review Board (IRB) approval from the technical college's IRB board and was granted permission to utilize institutional data and to interview any staff or students at the college (see Appendix D). The researcher also applied for IRB approval from the University of Wisconsin-Stout (see Appendix E). It was determined by both IRB's that the study met ethical standards. Planning and conducting an ethical study means that the researcher considers and addresses all anticipated emergent ethical issues in the study (Creswell & Poth, 2018). These ethical issues relate to the three principles guiding ethical research: (1) respect for persons (i.e. privacy and consent), (2) concern for welfare (i.e. to minimize harm), and (3) maximize justice (equitable treatment). All participants in this study were given informed consent forms (see Appendix F) and these forms were signed and collected before the interviews were conducted.

Instrumentation

Interviews were conducted with four Hmong-Americans who had completed programs in STEM fields. Before the interviews were conducted, participants were e-mailed the questions they would be asked and the consent form. Also, in the e-mail the participants were provided a brief overview of the study, including the topic and the confidential nature of the study. They were also told that the interview would be audio-taped and that the interview could take anywhere from 60 to 90 minutes. Participants were informed of the semi-structured nature of interview questions and were told that they may choose to not answer questions that they did not feel comfortable answering. The interview questions were open-ended, and follow-up questions were designed to help the participants fully engage in the interview (see Appendix G).

The interview questions were divided into five domains: (1) STEM career aspiration questions, (2) childhood and cultural questions, (3) parental, family, and community questions,

(4) institutional agent questions, and (5) economic questions. These five domains, in which the interview questions were embedded, encompassed most of the cultural and structural forces that could have influenced the participants in this study to pursue STEM careers. Additionally, these domains articulated to the research questions to ensure they will be answered. The strategy of intensive interviewing usually utilized by grounded theorists and suggested by Charmaz (2005) will be invoked in this research study. Charmaz (2005) explains that intensive interviews focus on research participants' statements about their experience and what it means to them as they indicate this during the interview. Because the researcher sought to understand the research participant's language, meaning and actions, emotions, and body language, intensive interviewing was an appropriate method for this inquiry.

While the interview was conducted, the researcher took field notes. These field notes added color to the nuances and subtleties that otherwise would not have shown up on the audio recordings. The field notes helped the researcher in remembering specific instances or participant observations in the interview process and added to richness to the audio-taped data. At the end of the interview, participants were thanked for their time. Participants were invited to contact the researcher if they had any feedback or concerns after the interview and if they themselves needed a transcript of their interviews for them to keep. Creswell and Poth (2018) explain the qualitative research interview is an attempt to understand the world from the subjects' point of view, to unfold the meaning of their experience, and to uncover their lived world. In addition to field notes, the audio-taped data obtained was used to capture the participants' experiences.

Data Collection Procedures

All of the interviews were recorded via audio and video, to capture the entirety of the content of the interviews. The audio-taped data that was acquired were transcribed verbatim with the use of a software program called Rev.com. All of the interviews were performed via videoconferencing. A setting that allowed the participant and the researcher to have maximum privacy was utilized for the videoconferencing. At the start of the interviews, the participants were reminded that the interview was going to be recorded and they were also assured that the interview would be kept confidential. At the end of the interview, they were assured that the transcripts would be stored in a safe location.

Data Analysis

Once the data from all four participants were transcribed, the raw data was analyzed by means of a process termed as “constant comparisons” (Corbin & Strauss, 2014). By performing constant comparisons, the researcher was able to break the raw data down into manageable pieces with each piece compared for similarities and differences. In the “constant comparative method” this is referred to as “open coding.” Lichtman’s (2013) illustration of the Three C’s of data analysis shown below visualizes this process. Data that was “conceptually” similar (but not necessarily a repeat of the same action) was grouped under the same conceptual heading. Through further analysis, codes were grouped together by the researcher to form categories, more commonly known as themes.



Figure 2. Three C's of data analysis: Codes, categories, and concepts (Lichtman, 2013, p.252).

At this point in the Three C's model process, categories were revisited to identify critical elements but also to remove redundancies. The final step in this process was to identify key concepts that reflect the meanings attached to the data that was collected. By reading and re-reading the data, some ideas appeared richer and more powerful than the others. These were “concepts” and this is how the data was analyzed in moving from codes, to categories, and to concepts.

Finally, during the data analysis process, the question arose, how did the researcher know when he or she was finished? Lichtman (2013) explains that unlike statistical analysis, in qualitative analysis there is no definite end; rather, the process followed reaches a logical saturation point. Glaser (1978) refers to this as “theoretical saturation.” Once this point was reached, the researcher found that no new learning was occurring; thus, the data was saturated, and the researcher moved on to develop conclusions of the findings.

Limitations

This study, being a qualitative study as opposed to a quantitative study, had different meanings when issues of reliability, validity and researcher bias were addressed. In a qualitative study, reliability is achieved through consistency in data collection and analysis techniques. The issue of external validity, which is the ability to generalize findings to a wider population, was

not the researcher's main objective; rather, it was a desire to gain a deeper understanding of the situation from participants lived experiences.

Some researchers like Strauss, Corbin and Corbin (1998) have attempted to minimize the effects of researcher subjectivity in qualitative inquiry methods, yet others like Charmaz (2005) have advocated for a more constructivist perspective in qualitative inquiry and highlight the importance of researcher reflexivity. Charmaz (2005) defines "reflexivity" as the identification and understanding of biases and assumptions that can influence the researcher's perspectives, decisions, and interpretations. The researcher adopted Charmaz's stance allowing for subjectivity to be incorporated into the discussion. For example, the researcher is employed in a STEM field. The close proximity to the researcher's interest and the area of study might be a concern to some; however, one can argue that experience that the researcher has in this STEM area could provide for richer descriptions of the participants lived experiences.

Also, the fact that the researcher is a first-generation immigrant employed in a STEM field might garner concern to some. By incorporating a strict protocol during the data collection and analysis process was instituted to ensure objectivity. By being a first-generation immigrant, the researcher might be able to develop a high level of trust with the participants and thus provide for meaningful descriptions of the experiences.

The scope of this research study will be within one technical college and its surrounding district within central Wisconsin. Therefore, the findings of this research may not generalizable or extrapolated to larger populations.

Summary

This study utilized a qualitative methodology to answer the research question as to what factors influenced the four Hmong-American research participants who are currently engaged in

STEM careers to pursue STEM careers. An intentional sampling technique was utilized to identify the group of people to be interviewed since this best informed the researcher of the research problem under examination. Through the use of audio recordings and field notes, the researcher was able to perform “open coding,” in which codes were grouped into categories or themes and then into concepts.

The proceeding chapter will present the data analysis and findings from this study. Included will be the meaning of the data and address the research question through a combination of narrative inquiry and grounded theory.

Chapter IV: Presentation and Findings

The purpose of this qualitative research study was to uncover why there was an underrepresentation of Hmong-Americans in STEM careers within the geographic area of central Wisconsin. Enrollment data (Appendix B), for Hmong-Americans, albeit aggregated under the Asian category, showed that proportionately the number of Hmong students enrolled in Science, Technology, Engineering, and Mathematics (STEM) programs at the technical college in this study has not kept pace with an increase in the Hmong population as a whole in this rural Midwestern region being researched. This issue of underrepresentation of Hmong in STEM fields has persisted for the past thirty years (Appendix A; Appendix B).

The primary focus of this study was to answer the overarching question: What factors have influenced Hmong-Americans who are currently engaged in STEM related careers to pursue STEM careers? Specifically, the following questions will be answered:

- (a) What role do family and the community play in influencing Hmong-Americans to pursue STEM education?
- (b) What role do family and the community play in influencing Hmong-Americans to pursue STEM careers?
- (c) What role do educational institutions play in influencing Hmong-Americans to pursue STEM education?
- (d) What are the economic factors involved with Hmong-Americans to pursue a STEM education and career?

Answering the above questions should achieve the goal of this study, which is to unveil what is causing the underrepresentation of Hmong-Americans in STEM careers.

In this chapter, the themes and concepts that emerged from interviews conducted with four Hmong-American STEM professionals will be presented. The interview focused on what factors led to the successes of these four Hmong-American STEM professionals. The intention of this research approach was to listen to the four participants' stories, and, by identifying the themes that emerged, the research questions will be answered.

Review of Methodology

To answer the research questions, a qualitative approach was utilized. Once the interviews were conducted, the data was transcribed and reviewed for accuracy. Next, by using a "narrative analysis," and performing "open coding," Lichtman's (2013) "Three C's of data analysis" was incorporated. Data that was "conceptually" similar but not necessarily a repeat of the same action, was grouped under the same conceptual heading. Through further analysis, codes were grouped together to form categories, more commonly known as themes. Finally, the process combined common themes into concepts until theoretical saturation was reached.

Figure 3 below outlines the four steps involved in data analysis.

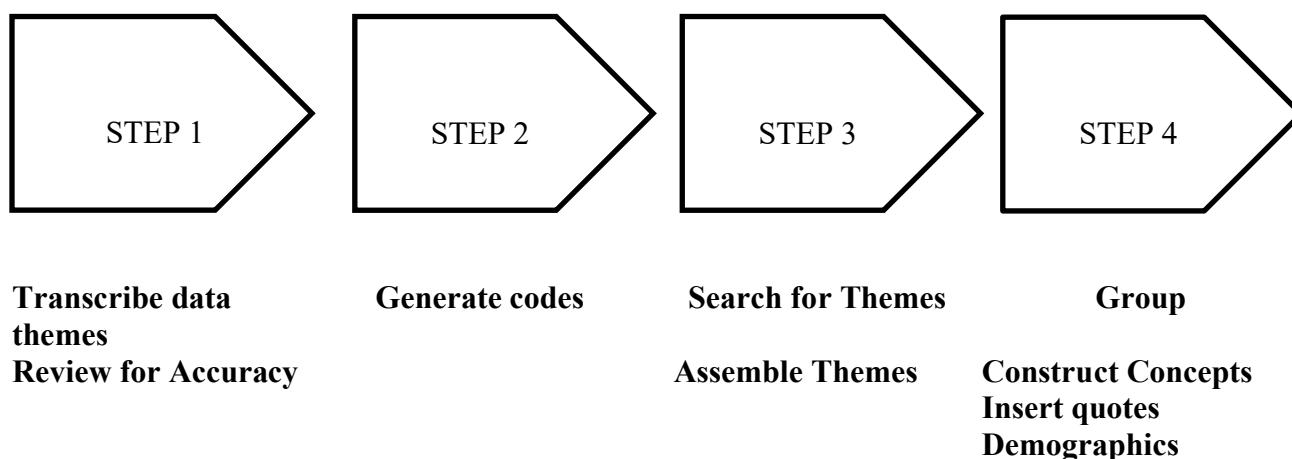


Figure 3. Steps in data analysis.

This section will introduce the four participants that participated in this research study with their respective pseudonyms P1, P2, P3, and P4. Participants will be described in terms of the following characteristics: (1) their place of birth and generational diversity; (2) their current and previous STEM occupation(s); (3) the high school and two-year and/or four-year college they attended; (4) the degrees that they have earned; (5) fluency with the English language; (6) motivation for pursuing a STEM major; and (7) socioeconomic status.

Participant 1 (P1). P1 was born in Laos and came to the United States when he was four years old. He is categorized as 1.5x Hmong-American as he came to the United States as a child. P1 has been teaching mathematics for the past fifteen years at a central Wisconsin high school, which is considered to be one of the largest public high schools in the state. P1 explains that he got a liking for mathematics while in high school and then decided to go on to the regional two-year University of Wisconsin College. Although he was not at the top of the class, he decided to go on to earn a bachelor's degree in mathematics and secondary education. At first, P1 had an interest in pursuing an engineering degree but found out that physics was not "his thing," so he stuck with mathematics.

P1 speaks fluent English and demonstrates good command of the English language. As a child in America, P1 loved watching the National Geographic Channel with his immigrant parents. His parents were able to share their experiences of trapping animals and the environment in Laos, and this sparked P1's interest in science, the environment and mathematical calculations. In addition, as a child, P1 helped balance his parents' checkbooks and mentioned that he could perform mathematical calculations in his head. It was at this young age that P1 realized that he was good at mathematics. P1's parents hailing from a low socioeconomic status were not able to help him financially. Fortunately, P1 was able to get

financial aid (FAFSA) and TIP grants (grants for first-generation minorities) to pursue his educational aspirations.

Participant 2 (P2). P2 was born in the United States. As per the parameters of this study, he would be classified as a second-generation Hmong-American. His parents came to the United States as teenagers. P2 works at the technical college in this study, and his job title is Flexible Learning Software Developer. Prior to this, he worked various work-study jobs both in Informational Technology (IT) and in Audio-Visual technology support when he was a student. He graduated from one of the local high schools in this study and then earned his Associate degree from the neighboring two-year University of Wisconsin College. P2 then transferred his credits to the neighboring four-year University of Wisconsin and earned a bachelor's degree in Information Technology (IT).

P2 is fluent in English and has excellent verbal and written English language skills. P2 mentioned that as a kid growing up, he loved playing video games and still does. His interest in computers sparked when he was ten years old. On any given occasion, his dad had to have one of their relatives come over to fix P2's computer when it was not working. When the issue happened again, P2 was able to fix the computer himself, having learned from watching his relative fix it. From this time on, P2 found that fixing computers was something that came naturally to him. P2 was not very fond of physics and mathematics; hence, he chose to pursue a career in information technology rather than engineering. Both of P2's parents had dropped out of college and did not have jobs that could support his education. Fortunately for him, P2 was awarded financial aid and grants at both the two-year and four-year institutions, which helped him achieve his educational goals.

Participant 3 (P3). P3 was born in the United States and is a second-generation Hmong-American. His current job title is Mechanical Designer/Drafter. He works for an aeronautics/aerospace company in Southeastern Wisconsin that produces equipment and instruments for cockpit displays. Before this, he interned as an Automation Engineer designing robots and end effectors, which are devices attached to the end of a robotic arm. P3 attended a local high school and then attended a four-year University in Wisconsin well known for its engineering programs. He graduated with a Mechanical Design/Drafting degree and currently lives in the southeastern part of the state.

P3 is fluent in English and articulates his thoughts well. His inspiration to become an engineer came from watching his dad “fix stuff” around the home, his cars, and in their gardens, where he helped out from a very young age while still in school. His parents were first-generation immigrants who came here in their twenties and were not very wealthy. P3’s parents’ income could not supplement his education, but through scholarships and financial aid he was able to get most of his schooling paid for.

Participant 4 (P4). P4 was born in Laos and later spent time in the refugee camp Ban Vinai before coming to the United States along with his wife when he was just eighteen. P4 went through some difficult times in Laos and lost everything to the communist Vietnamese. P4 and his wife moved from Laos to the refugee camps when he was a teenager, and they were destitute. Even basic needs like water, food, and clothing were sparse. The little schooling he had while in the camps was in Thai and not in English.

Upon his arrival to the United States, he attended ESL classes for the first year in the church and then later at the technical college. He enrolled in the Welding program and earned a welding degree. However, P4 found out that welding was not for him, so he then pursued

earning an Associate's degree in Electronics. Through his own research, he figured out that technology was going to advance rapidly, and an electronics degree was worth pursuing. He was the first Hmong-American to graduate with an Associate's degree from the technical college in 1993. While in the United States, he worked very hard at his education because he knew he had to get good grades to keep getting his financial aid and grants so he could pursue his education as well as support his wife, who only worked part-time since she was raising a family.

After graduation, he got a job as an Electronics technician working for a telecommunications company and has been there ever since. However, everything did not go as smoothly as planned. After working for the telecommunications company for fifteen years, and due to downsizing, P4 was laid off. It was then that P4 went back to school to earn another Associate's degree in Information Technology (Programming). It so happened, that after his graduation with his second Associate's degree he was called back to work for his original telecommunications company because he had additional programming skills and has been there ever since. P4 loves mathematics but openly admits that up to this day, he still struggles with the English language. According to him, 80% of electronics is mathematics and pointed out that he is not very good with English but is very good at math. Some of this passion for mathematics may have originated from his dad, who was a teacher in Laos (part-time) as well as an employee of the Central Intelligence Agency (CIA) part-time.

Thematic Analysis

Analysis of the data, using the Lichtman's (2013) "Three C's of analysis," resulted in four concepts and twelve themes. The data revealed four overarching concepts: (1) parental influences on academic success, (2) career actualization, (3) support systems, and (4) overcoming challenges and barriers. The common themes within each of these concepts are

highlighted in Figure 4 below and will be explained subsequently in relation to direct quotes of the participants' responses to the related questions. Figure 4 below summarizes the four concepts with their respective themes and the corresponding number for the participant providing the narrative.

Concepts	Themes	Participant 'N'
Concept 1: Parental Influence on Academic Success	Theme 1: Participants felt an obligation to their parents to succeed in school as they viewed education as a means of social mobility	P1, P2
	Theme 2: Participants looked at their parents' struggles as motivation for success	P3, P4
	Theme 3: Participants were not pressured to choose their (STEM) majors but just to go to college.	P3, P2, P1, P4
Concept 2: Career Actualization	Theme 4: Career actualization in STEM was triggered at a young age	P2, P1, P3
	Theme 5: Participants were the first in their families to go to college to pursue a STEM career and felt compelled to prove that they were capable of graduating despite what others believed.	P4, P1
	Theme 6: Lack of role models in STEM	P1, P3
Concept 3: Support Systems	Theme 7: Financial Support from federal, state and governmental agencies helped the participants achieve their educational aspirations.	P1, P3, P2, P4

	Theme 8: Helpful Faculty and Staff (tutors) although career counselling could be improved	P4, P1 P1, P4
	Theme 9: First and 1.5x were more likely to seek academic help compared to second generation	P4, P1, P2, P3
Concept 4: Overcoming Challenges and Barriers	Theme 10: Participants were always aware of their identities as minorities in terms of their culture and language.	P3, P1
	Theme 11: Participants expressed that were persevering when it came to their education, but second-generation described themselves as having poor study habits compared to the first and 1.5x generations.	P3, P2, P4, P1
	Theme 12: Participants in this theme report that they encountered subtle microaggressions during their educational paths.	P3, P2, P4, P1

Figure 4. Overarching concepts, themes, and participant numbers.

Concept 1: Parental Influences on Academic Success

Theme 1: Participants felt an obligation to their parents to succeed in school as they viewed education as a means of social mobility. Participants felt supported and encouraged by their parents to pursue an education. Participants felt obligated to their parents to succeed in school because their parents were not afforded these opportunities and hence had to work multiple low paying jobs in order to make ends meet upon coming to the United States. Their parents viewed going to college as the only means to upward social mobility for their children.

P1[1.5x generation]: I would say my parents had a very high expectation of education. I knew that was the way to make oneself important or raise oneself in our society. They always encouraged it. It was never a question of whether myself or any of my siblings would go to college. It was a matter of where and what for, so it wasn't always, Oh, I'm going to take a year off or I'm gonna, go into the workforce. It was always just going to college, you gotta pick something, you gotta pick some field of study or something to do. At that point it was kind of up to you.

P2[Second-generation]: My parents, I think they both dropped out of high school, so they couldn't really help me..... So, when I got out of high school, I went to go work right away, but I was just working at like McDonald's. So I was working at a fast food restaurant ...and then I decided one day I don't feel like working fast food anymore. So I went to UW -XXX County. So I went to a two year university and I finished my, my associates degree there. And I kind of had a feeling I knew what I wanted to do already. because I always kinda liked computers and stuff. So, I decided, okay, I'm gonna do my generals here. And I hope that XYZ lets me transfer all my credits and they did. So I transferred to them, the, four year university and kind of just went from there.

Theme 2: Participants looked at their parents' struggles as motivation for success. Participants, albeit from different generational diversity, P3 (second generation) and P4 (first generation) were well aware of the sacrifices their parents made not only while in Laos and then the refugee camps in Thailand, but also when they came to the United States as immigrants. Parental sacrifices served as motivation for the students to succeed in school and they wanted to make their parents and their families proud.

P3[Second-generation]: I think our parents pushed us to pursue an education, that was important for them, as first-generation immigrants, they saw the importance of that and we saw the sacrifice that they put in. So we put a lot of effort into education and it was a sense of pride for them.

P4[First-generation]: My dad was a teacher in Laos. Yeah. He was a teacher and he had two jobs, one with the CIA, he taught part-time and worked with the CIA part-time. Then, when I was little about 10 years old, I saw him do reading, writing and do math, but I don't know it that's important but when I came to this country, I keep thinking, my life should be better than my dad, and I had to find the right direction for my life. That was why I chose electronics.

Theme 3: Participants were not pressured to choose their (STEM) majors but just to go to college. Participants described that their parents did not pick their majors for them but pushed them to go to college. The second-generation participants were pushed more by their parents to earn a college degree compared to the first-generation and the 1.5x generation.

P3: [Second-generation] My parents didn't make me become an engineer. They're just happy that I would go into college. They really kept pushing us to go to college. The engineering field wasn't in their plan, you know, it wasn't, but going to college was important.

P2: [Second-generation] My parents came here as teenagers. Something like that....May be in their twenties. They did not influence me to pursue this STEM career..... not so much. It was just kind of my parents, they just said, Hey, go to school if you want a good job. I was like, alright, alright, I will go to school.

P1: [1.5x generation] My parents did not influence my decision to become a Math teacher.... really it was a lot of, personal preference of what I chose to do. They did want us, they did want me to continue in school and you know, create a good living well for myself and make,

you know, make life easier for myself, but I don't think they minded us or myself going into any particular field. You know, just like many other parents. That'd be a maybe thinking, um, it would be really nice if you were an engineer or a lawyer or a doctor, but as long as you have some direction

P4:[First-generation] My parents did not influence my decision to pursue Electronics. No they had no idea. Because like I say, first-generation [parents] in this country, you know, and they didn't know how the future will come out. When I was in the camp we had no idea. How is the world going on? We had no idea and we didn't see anything in the future. And then when I came to the US, I keep thinking and say, well, which job is better for me. And I thinking, and I figure out, and I read the news and whole bunch of different things, and I decided Electronics is my job.

Concept 2: Career Actualization

Theme 4: Career actualization in STEM was triggered at a young age. Findings pertaining to the theme of Career Actualization in STEM being triggered at an early age showed that interest in a STEM career for three of the four participants developed at a young age. The 1.5x generation participant and both second-generation participants explain that they were either involved in STEM related hobbies in their childhood or learned from watching an elder fix something that was broken at an early age. The fourth participant (first generation) actualized his STEM career through his own research when he got to the United States at the age of eighteen from watching the news and reading newspapers.

P2 [Second-generation] I've played a lot of computer games when I grew up. There was this time my computer wasn't working and I was like, what's going on? I got to play my games at that. We had, we had a, relative that my dad's like, Hey, can you come fix my [son's] computer?

And then he fixed it. And he kind of showed me what, like the process, what he did. And I was like, okay, cool. And then that issue happened again. And then I just kind of did what he did. And I was like, wow, it feels really good to get this working. So I was like, so ever since then, I was always kind of interested in anything computer related.

P1 [1.5x generation] When I was young, I remember helping my parents balance checkbooks and do calculations for bills and what not. And I remember one specific instance, they couldn't balance something out and I was doing the calculations in my head and I found the mistake. So that kind of, that was one of the earliest times I remember saying, you know, I can do this. That's kind of fun. Being able to do the calculation and doing it mentally without writing it down takes practice. But it's one of those things that made me remember, you know, way back of when my interest in mathematics started and when I realized that that's something I good, I'm good at. That's something I can do.

P3 [Second-generation] When I was growing up..... my dad was, you know, we were not wealthy, my dad was a working man. So if there was anything that needed to be fixed or car fixed or home needed to be fixed he would do it himself. So I was always there next to him and he would always ask me help to him out. So there's stuff like that. There was a farm yard by our garden and a junkyard too, I tinkered around with all that stuff.

Theme 5: Participants were the first in their families to go to college to pursue a STEM career and felt compelled to prove that they were capable of graduating despite what others believed. All participants were first in their families to pursue a STEM career. At times, when instructors at the high school or college doubted their academic abilities, they were determined to prove them wrong.

P4[First-generation] I kept pushing and pushing, but you got to make sure you got good grades. I was the first Hmong graduate for Electronics, I think, for XYZ [Technical College]. And they, they told me, that I do a very good job. And my brother that did graduate from high school, then he [too] went to XYZ and he graduated. I think security, police, police science, science..... They [instructors] just showed us a little bit, but not, not the main idea how you handle it. Just explain a little bit, but you had to push yourself better to read more and study more. And the ones that help you education..... like uh, yeah, a first generation, like me in this country, if you took the class, then you do great, good job and some instructors complain a little bitsaying..... Your English is not good, but why you do so good at Tests? But I'm not very good at English and not, not very good English, but my math, I'm very good at math. In electronics they use, like 80% for math to do something until they come out, then I decided to choose the electronics.

P1[1.5x generation] I think the one feeling that I had about high school was that a lot of my teachers were not negative, but I, you know, there's like this sense that they didn't really want to encourage you or felt like I couldn't do certain things. And I guess I'm stubborn that way because when I feel that somebody, you know, was, was in a sense telling me what, that I can't do something, I get stubborn and I, you know, I choose to do that just to prove a point I guess. So there were some teachers that didn't, they were never negative or anything like that, but they didn't really guide you or encourage you to seek something out. Not everything is going to be able to help up all of the students, but that's kind of how I saw the situation where it felt about the situation. So part of me is like, okay, I'm definitely going to do this. I don't, nobody encouraged me or said you would be good doing this, you know, so I chose to purposely go, go a certain direction because of that.

Theme 6: Lack of role models in STEM. Participants noted that there was a lack of immediate role models in STEM, although some did mention knowing a distant relative engaged in a STEM field.

P1[1.5x generation] I have a, an uncle who was a mathematics teacher that lives in the Minneapolis St Paul area. So he was the earliest adults that I knew that was in the teaching field. And then his younger brother, another uncle was in the engineering field. So they often reinforced or encouraged us to continue our education and make more money and you know, just make life easier or better for ourselves and our family. So they always viewed education as a very high expectation. And then it was something that was expected of us cousins.

P3[Second-generation] I didn't have any role models to look up to in our family, very few, if any for engineering..... just the support, our peers and to know that we made it into something like that, because if we don't have that encouragement, then it's very difficult to be ourselves. So I think to know that somebody has gone through it and has accomplished it, confidence can be instilled in people. So that certainly was very important. We don't have a lot of that. If you don't have a lot of people who come speak at graduations that are engineers, you know, it's mostly business people Like at our High school, like all our graduation parties, they're master's in business, masters, whatever it wasn't engineering. You don't see people.....All we heard was, wow. Somebody went for it [engineering] and they came back without an engineering degree. That does no help?..... I did have an uncle, my uncle, Maybe if anybody, I graduated with the same degree that he did, so that influenced me a little bit. I wish I would've gotten farther.

Concept 3: Support Systems

Theme7: Financial Support from federal, state, and governmental agencies helped the participants achieve their educational aspirations. All participants mentioned that they did not come from wealthy families and that their parents were not able to provide for their education monetarily. Their parents, not being afforded a formal education, did not have high paying jobs and could not help them financially. Fortunately, the participants were able to receive financial assistance in the form of financial aid, grants, and scholarships to pursue postsecondary education.

P1[1.5x generation] In starting out, you go into college and then you see all the bills that is kind of eye opening. Like, oh my gosh, how am I going to pay this amount? You know, and my parents didn't make much money, so I knew that I wasn't going to be able to ask my parents to help me financially. They were very willing to with, with whatever they can, but you know, because I was helping my parents with their finances, I already knew even if they wanted to, they couldn't. Um, but filing forms, FAFSA and getting grants was very helpful for me to pay for a college. I think one of the grants that I got, I don't even know if it's out there anymore, those call that TIP grant and it was for minorities, for first-generation to go to college.

P3[Second-generation] I got financial aid. I got scholarships, financial aid just because my parents were first-generation and their income.... income was not very supplemental for us all. That's how we got most of our school paid for. So for the financial aid help and Pell grants and all those kinds of things helped pay for school.

P2[Second-generation] I actually did get a lot of help from grants and a lot of financial aid at the XYZ [two-year UW] and also at the XYZ [four-year UW], That helped and put me through. I got financial aid and grants and stuff. Pell grants. And I also had work-study, I thought

I wanted something more related towards what I wanted to do and I did find some related stuff doing work-study. I did this, while still staying at home, so I didn't have to pay for room and board or whatever, you know, and food and stuff was all at home.

P4[First-generation] Yeah. I appreciate it for the system for financial aid, the student grants from the state and they were from three different programs to help me to complete my education.....that was very helpful. And that one, you have finance to pay your class and you don't worry about it. You kept pushing and pushing, but you got to make sure you got good grades. And you qualify for the financial aid from the government. At that time I was just at home. I got governmental assistance, I just lay there at home and that time, my wife worked part time, but they don't have money. You have to limit the money to use it. And I have school and I pushed myself very hard until I've done it.

Theme 8: Helpful Faculty and Staff (tutors) although career counselling could be improved. The findings in this theme describe the helpful role that faculty, staff, tutors, and fellow classmates of the Hmong-American participants played during their educational journeys.

P4 [First-generation] This country is very helpful and also the instructors at XYZ are very helpful. They're very helpful for students, they show respect and they do a good job to make sure the students do a good job in class, that's why..... I told my brother and my sister and my daughter say, if you cannot go further for education, like UW-Madison, then this is the first option for you to go to [XYZ] technical college and my brother is also a graduate of [XYZ] technical college..... And like I told you, every instructor is very helpful and they keep pushing you to the right direction. And you will, if you confuse something, you not understand that you have to talk with them. You don't talk, you would not communicate with your instructor or the community, the school. Then you will not be very strong in there. You cannot handle it, but no,

your instructor, you know, the counselor, the tutors, you knew everything and should be pretty good for you. But about the system, I think as a people decide to take a major class, they should understand themselves, not the instructor and not the community. They should prepare themselves for say, this is my major. I need to do it.

PI[1.5x generation] I had a math teacher back at that, Marshfield senior high that was fairly supportive, encouraging and she just kind of made math have some logic to it. Then you had step by step processes..... And at the two-year center in XYZ [two-year UW] County, I had the professor that allowed us [me and a colleague] to come early and work, and I appeared to teach half the class or reteach half the class. Other students, pretty soon after a couple of weeks started coming and we had probably about three quarters of the class coming in early to get questions answered, you know, between the two of us, we would be able to answer all of the questions. And the first time the professor walked in and asked, it was about time for class to start. We kind of hesitated, we were gonna stop and the professor said, no, no, you guys are doing great. He says, keep going.....

However, participants also described that faculty and counselors were not really negative but were not really persuasive and encouraging in terms of helping Hmong-American navigate their educational trajectories.

PI[1.5x generation] I think the one feeling that I had about high school was that a lot of my teachers were not negative, but I, there's like this sense that they didn't really want to encourage you or felt like I couldn't do certain things. And I guess I'm stubborn that way because when I feel that somebody, was in a sense telling me what, that I can't do something, I get stubborn and I choose to do that just to prove a point I guess. So there were some teachers that didn't, they were never negative or anything like that, but they didn't really guide you or

encourage you to seek something out. Not everything is going to be able to help up all of the students, but that's kind of how I saw the situation where it felt about the situation. So part of me is like, okay, I'm definitely going to do this. So nobody encouraged me or said you would be good doing this, you know, so I chose to purposely to go in a certain direction because of that.

P4[First-generation] I think it is a good idea to get more students [in Electronics] to talk to the recruiter like XYZ [Hmong counselor], if they come to talk to him/her, the [counselor] should, talk with them about their major, because some did not, they [Hmong students] took like a different major, for just a first or second semester.....then they quit because they don't like it. They know financial is screwed up and they just quit..... One thing you instructors have to explain, to tell them about the future the job. If you are enrolled in Electronics or in Machine tool, in electronics, how much will you make in the future and how much you make with the future for machine tool for the job, because machine tool is.....It's so dirty, so dangerous and things are so heavy and if the people want better jobs, then, they have to take electronics, little bit tough, but you got better pay when you graduate, who got better job and that's the things that people had to think of that and not think about anything else.

Theme 9: First and 1.5x were more likely to seek academic help compared to second-generation. This theme demonstrated that the first and the 1.5x generation (P4 and P1) readily sought help from faculty and tutors in terms of academic support when needed. However, both second-generation participants (P2 and P3) mentioned that they did not seek help from faculty or peers but chose to do things by themselves.

P4[First-generation] When I took the major classes [in electronics], I have a white student to be my tutor and they [the instructors] sent me to him to help me understand

[electronics]. They [the instructors] told every student, say, if your tutor is not helpful, please talk with the instructor, but they [tutor] do a good job. Every tutors did a pretty good job.

P1[1.5x generation] At the college level, the professor doesn't have that much time. He spent three hours with you a week and that's it. And they usually are teaching new concepts. And then you're supposed to take that and practice. Well, halfway through the one of the semesters I was completely lost and couldn't figure it out..... But then I had a classmate who was, she was a little older, she goes, well, what's the correct term, the non-traditional student. But she, she was extremely helpful because he [the professor] wanted us to do well. So we started a little group where we just kinda sat down, went over the problems and when we first started I couldn't understand how she was coming up with what to do with the information. Um, and then eventually I realized, you know what, I can't just go to class. I can't just do the assigned homework. I actually have to pick up the textbook, you know, and read the textbook, make sense of the textbook. And that's where I got all my information from. Then I was, the professor will cover the big ideas, but then there were little details that I wasn't aware of. So it took me a little bit to figure that part out and said, okay, if the professor is getting these practice problems from this section in the textbook, I need to read everything from the beginning up to that section before I really understand how to use the material or how to do the calculation and you know, have a thorough grasp of what is happening and how it's happening so that, um,....

P2[Second-generation] I didn't really get any mentorship or help. I kinda just did it. I just like to do things by myself rather than it's like, partially that it's partially that I also just didn't feel like I, I don't know. I just don't what, when, when I'm in a one, whenever I was in any, um, any of those, uh, you know, in school, I never felt like, uh, like they wanted to help me, so I just kinda just did it on my own. And I was just like, okay, I'm just going to learn this.

P3[Second-generation] I think there is a fear, there is a challenge we're not familiar with just knowing what I know now, that way, you know, I would definitely just go back to get my [full blown] engineering degree. Um, you know, just the support, uh, our peers and know that yeah, we made it into something like that, because if we don't have that encouragement, then it's very difficult to be ourselves.

Concept 4: Overcoming Challenges and Barriers

Theme 10: Participants were always aware of their identities as minorities in terms of their culture and language. Hmong-American participants were typically aware of their identities as minorities. At times, second-generation participants described that counselors would put them in Asians Clubs or in ESL classes just so that they felt that's where they would feel more comfortable with fellow relatives and Asian friends.

P3 [Second-generation] The counselors in high school would put us in an Asian club. There was just an Asian club, not a Hmong club. So everybody's was in it, I, Laotians, Vietnamese everybody who was Asian, honestly, that didn't help us at all. Just kept us too comfortable in our zone we did get support from the counselors. To me, that was a, I would say that was a deterrent stepping out and exploring other, you know, exploring other clubs. Like I wish I would have taken me, you know, mechanics club or the key of the minds or, you know, stuff like that, which I regretted, but because I got help in that Asian club where all my friends are there, if they were, if they would, I understand his job is to kind of to encourage us.

P1 [1.5x generation] One, I think the parent guidance is a lot of the parents are busy working or they're first-generation immigrants, you know, they're kind of in the same boat unless the student has the drive to sit down themselves and force themselves to go through the work and the materials and, you know, and math is one of those things that you can't skip sections and do

well on the next section, so you kind of hinder yourself that way. Um, I think even in the Hmong population, it is looked down upon if you are in the ESL program, if you were born and raised here in the United States because you know, the common, the common thought is you were raised here, you know, the language, what's your problem? You know? So I think that really hinders students and families from leaving and wanting to have these students in the, um, ESL courses..... my English is pretty good but I see students who their oral language and in conversation language is very good as well cause they grew up here, you know, uh, media and friends and community, they pick up the language and they're able to speak of very clear English. But when you start talking about academic language, that's where they really fall apart because they don't get that outside of school. And if their parents are not able to help them with that, that becomes a problem.

Theme 11: Participants expressed that were persevering when it came to their education, but second-generation described themselves as having poor study habits compared to the first and 1.5x generations. All four participants reported to having worked very hard while in school and both at helping their parents when they were not in school. The first and 1.5x generation participants demonstrate a stronger work ethic than their second-generation Hmong-Americans and they also tend to have better study habits than the second-generation participants.

P3[Second-generation] One barrier there was while I was pursuing my education, I think there's a sense of, I think it's just a lack of, I think it's still lack of discipline in the study habits, I think would be important. That was a big factor. I did not have good study habits. For me and like a few others, this was difficult. Like with, I can see that now because I can see my kids growing in my high school, graduating high school. Oh yeah. And the amount of effort that also, as parents, we are putting in, it's going into him to, uh, choose it as far as study habits it's like

night and day compared to what my parents did.....My parents couldn't help me with my study habits because they didn't go to school. They thought it was helpful and they thought it was homework. But no, like I said, we, we didn't, we, we grew up with a big family, so my parents they worked a lot you know, um, you know, instead of coming home right away and get it on the desk and doing homework, like I have my kid do, I had to go to the garden, our family. So when we got into college, study habits were a big factor because I didn't know.I didn't know how to study very well. I didn't know I had to come home and set a schedule and how to get it done.

P2[Second-generation] I just had very, very bad study habits. I've I feel like it's just from how my everyday life at home kind of was. It just wasn't very structured and it didn't really give you the growth to like go, okay, so I need to do these things like this and these things. I just kinda it's like, uh, someone [the parents] tells you, Hey, do your homework, but they don't, they [the parents] don't tell you anything other than that. So you're like, my parents didn't really force me to do my homework. They would tell you do your homework, but they would tell you to study, but it's almost like you don't know how you should be doing it. You kind of just go, okay, so I'm gonna, I guess I'll try to do what the instructors, uh, showed me. Right.

P4[First-generation] I was getting government assistance. My wife worked part time, but we don't have money. Not much. You have to limit the money to use it. And I have school and I pushed myself very hard until I've done it, like my mind can open it, that it does this..... And I keep pushing and pushing well. So it's first and second semester it is hard to understand if you quit for first semester or second semester, then you lose everything, but you got to keep going and going. And then you reach the three, the third semester, they you know everything and the fourth semester is going to be easier for you to complete your major program[Electronics].

P1[1.5x generation] In our family education was something that was held in high esteem. So they (our parents] never said you have to, but they always, you know, indicated that we would like or really appreciate if you go into this in this direction of doing something after high school other than work entering the workforce. And I would say from personal experience, you know, as I often tell the younger kids now students nowadays that you guys don't know what hard work really is. Once you can compare hard work to education, you're thinking too. I'm thinking to myself, I would rather do the education than the manual labor in the different types of jobs that I've had growing up.....

Theme 12: Participants in this theme report that they encountered subtle microaggressions during their educational paths. Each of the participants described that they had experienced subtle racialized invalidations by faculty and staff during the pursuit of their STEM degrees. They felt that they were treated as though they were foreign and non-US citizens. In some instances, their English language skills were challenged, and while well meaning, teachers sent them to ESL. Other instances included testing their English; another participant (the first generation) who possessed limited English language skills was questioned on his ability to do well on tests because of his sub-par English skills. The 1.5x participant reported that just because he (and other Hmong) looked Asian, it was assumed that they were good at Mathematics, automatically reinforcing the model minority stereotype.

P3[Second-generation] They [counselors] sent us to the Asian club. There was just an Asian club. So everybody's was in it, I, Laotians, Vietnamese everybody who was Asian, honestly, that didn't help us at all..... Maybe they [counselors] could get you involved with, like instead of counseling inside the Asian club go right into the other clubs and say, yeah, let's do this. That's given they comfortable when you're in high school. Right. So you're a minority, you

know, where you're like uncomfortable and you feel more like an outsider. So that's how I felt. It'd be like, well, we don't need to know. I walk up, you know, hold our hands and know that yeah. You know, maybe I would have initiated, but that's just me. Me, I'm just comfortable going into those. Cause, it was probably just me or, you know....

P2[Second-generation] I think they got me tested[for English]. If I remember correctly, they got me, they tested me. That's really all they did. Yeah. They just tested me and they're like, Oh, your English is fine, then that was it..... yeah, I know what it is. Someone [counselor], when I was like in elementary school or something sent me to an ESL class. Yeah. It was strange, but I think they just wanted to, they're probably like, Oh, he's Asian. He wants to go hang out with his cousins or his friends or whatever. Then, they're all together. I don't know.

P4[First-generation] In electronics they use, like 80% for math to do something until they come out I'm not very good at English and not, not very good English, but my math, I'm very good at math..... Yeah, the math. I just say did myself, but the English, I need a tutor to help me. Yeah..... If like uh, yeah, a first generation, like me in this country, if you took the class, then you do great, good job and some instructors complain a little bitsaying..... Your English is not good, but why you do so good at Tests?

P1[1.5x generation] I think the stereotypes that Asians are good at mathematics, at least in the Hmong population, that stereotype really hinders the Hmong population because technically we're Asians. But you know, there's very few that are actually very comfortable and good with mathematics. There's not a lot of foreseen needed support there even though there is needed support and guidance in that field..... I've seen a lot of [Hmong] students who go through my classes that are not good at mathematics. Or they're always in the lower level high school classes. There's some, in a sense, an overrepresentation of these students in the lower

mathematics courses..... I see students who their oral language and in conversation language is very good as well cause they grew up here, you know, uh, media and friends and community, they pick up the language and they're able to speak of very clear English. But when you start talking about academic language, that's where they really fall apart because they don't get that outside of school. And if their parents are not able to help them with that. One of the classes that I teach is geometry and I feel like our geometry at [XYZ high school] is, has an extremely high expectation of understanding how things work. Being able to explain why the geometry works on segments from everything from a point, to triangles, to polygons. And the students aren't able to read the material and explain what they mean. Oftentimes I've questioned certain students on did you study the, this theorem or this property? And the student can recite that theorem or property to me, but then I'll ask him, now what does that mean? Can you draw me a diagram and walk me through what it means? And they're like, I have no idea what it is. They can recite the words for you, but I don't know what, you know, how it is applied. So the academic language art of it and understanding it thoroughly, that's where a lot of the students struggle.

Summary

A total of four overarching concepts and 12 themes emerged from the participants' salient narratives about their educational journeys in pursuit of a STEM post-secondary degree. There were commonalities and differences in the participant stories primarily based on their generational diversities. P1 is 1.5x generation Hmong-American who came here as a child, earned a Bachelor's Degree in Mathematics and Secondary education, and is currently a High School Math teacher. P2 is a second-generation Hmong-American, earned a Bachelor's Degree in Information Technology, and now works at the technical college in this study as a Software Developer. P3 is a second-generation Hmong-American who attended the local high school and

graduated with a Bachelor's Degree in Engineering Management and works as a Mechanical Designer/Drafter for an Aerospace company in southeastern Wisconsin. P4 is a first-generation Hmong-American who was the first Hmong to earn an Associate's Degree in Electronics from the technical college in this study and who later went back and earned a second Associate's in Information technology (Programmer). P4 has been working as an Electronics Technician for a Telecommunications company in the region of this study for the past twenty-seven years.

An "open coding" process that utilized Lichtman's (2013) "Three C's of data analysis" was incorporated. Data that was "conceptually" similar but not necessarily a repeat of the same action was grouped under the same conceptual heading. Through further analysis, codes were grouped together to form categories, more commonly known as themes. Finally, the process combined common themes into concepts until theoretical saturation was reached. The findings revealed four overarching concepts: (1) parental influence on academic success, (2) career actualization, (3) support systems, and (4) overcoming challenges and barriers. Twelve categories or themes resulted from coding of the participants narratives and these themes were grouped into their respective concepts. Chapter 5 will present the summary, conclusions, and recommendations of this study.

Chapter V: Discussion, Conclusions, and Recommendations

This qualitative research study explored the underrepresentation of Hmong-Americans in Science, Technology, Engineering, and Mathematics (STEM) careers within the geographic area of central Wisconsin. Specifically, the technical college in this study had experienced low enrollments of Hmong students in its STEM programs. State-wide Technical College data (Appendix B) showed that proportionately, the number of Hmong students enrolled in STEM programs has not kept pace with an increase in the Hmong population as a whole in the geographic area being studied. Research showed that for the United States to stay competitive in a global economy, colleges must increase the number of graduates in STEM fields. A 2012 report published by the President's Council of Advisors in STEM emphasized that the number of STEM graduates needs to increase by 34 percent compared to current rates to satisfy the STEM professional workforce (President's Council of Advisors on Science and Technology, 2012).

Summary

This research study employed a narrative inquiry and a grounded theory approach that included four Hmong-American STEM professionals and focused on what factors led to their successes in these fields. By listening to the participants' stories and by identifying the themes that emerged from the interviews, the answers to the research questions will be unveiled.

The study's research questions were as follows: What factors have influenced Hmong-Americans who are currently engaged in STEM-related careers to pursue STEM careers?

Specifically,

- (a) What role do family and the community play in influencing Hmong-Americans to pursue STEM education?

- (b) What role do family and the community play in influencing Hmong-Americans to pursue STEM careers?
- (c) What role do educational institutions play in influencing Hmong-Americans to pursue STEM education?
- (d) What are the economic factors involved with Hmong-Americans to pursue a STEM education and career?

The participants for this study comprised of Hmong individuals that had a connection to the Midwestern region where the technical college under study is located and were currently employed in STEM careers at the time of the study. To find Hmong individuals to participate in this study, a purposeful sampling approach was utilized. Interviews lasting 60-90 minutes were conducted with the participants. Participants were e-mailed the interview questions before the interviews along with the consent-to-participate form. The participants were provided a brief overview of the study, including the topic and the confidential nature of the study. The interviews were audio-taped, then transcribed and reviewed for accuracy.

Data analysis was conducted using a narrative analysis, and performing open coding. Lichtman's (2013) "Three C's of data analysis" was incorporated. Data that was conceptually similar but not necessarily a repeat of the same action was grouped under the same conceptual heading. Through further analysis, codes were grouped together to form categories, more commonly known as themes. Finally, the process combined common themes into concepts until theoretical saturation was reached.

The findings suggest that the four Hmong-Americans STEM professionals in this study were influenced by both cultural and structural forces in their educational journeys. These

cultural and structural forces were not mutually exclusive but interacted with each other in complex ways, shaping the educational trajectories of Hmong-American students.

These cultural and structural forces have both positively and negatively impacted the participants in this study, which will be discussed below as the four overarching concepts are presented.

Discussion

Four overarching concepts emerged from the thematic analysis that was performed. These concepts were identified by the research participants as they discussed their educational and professional career trajectories. The four overarching concepts along with the themes associated with them are discussed below.

Concept 1: Parental influences of academic success. Participants described that their parents had high expectations of them in terms of their education and viewed going to college as a means of social and economic mobility. This finding is aligned with prior research on the Hmong conducted by Hutchinson & McNall (1994) and S. J. Lee (1997) that validated Hmong parents' beliefs that education was the key to social mobility and status attainment in society. The positive type of parental influence on Hmong-American students is consistent with Museus' (2018) findings that reveal that going to college is what Hmong students just had to do. This cultural force positively influenced the four Hmong-Americans in this study and helped them succeed in both high school and college and, in turn, propelled them into their respective STEM careers.

In addition, participants explained that sacrifices that their parents endured while in Laos, the refugee camps in Thailand, and when immigrating to the United States were what helped them put an extra effort into their education. Participants described that their parents had

dropped out of high school, and some participant parents had no schooling at all, and they wanted to have a better life than their parents. Their parental sacrifices motivated them to succeed. Participant P3, a second-generation Hmong-American, who works as an engineer stated: “My parents pushed us to pursue an education.....as first-generation immigrants, they saw the importance of that and we saw the sacrifice they put in. So, we put a lot of effort into education.” This influence of parental sacrifice and students wishing to pay back their parents was consistent with Museus’ (2018) findings, albeit Museus’ findings were of Vietnamese and Cambodian-American students.

Participants also described that their parents were not instrumental in picking their STEM majors, but they just pushed them to go to college. Parents were also unable to help them in filling out the necessary paperwork for admission or financial aid. They could not help them with their homework. Participant P1, a 1.5x generation high school Math teacher stated:

My parents were immigrants to this country, so they did not have the means to help me along with my education. They could not help me filling out forms, getting the documentation that I needed, it was all kind of on my shoulders. This made things difficult. And when the workload got harder with my classes, my parents weren’t able to guide or help me with that part at all.

The lack of involvement in their children’s education could be due to linguistic and cultural barriers most immigrants and parents face as confirmed by Ngo and Lee (2007). This type of “non-involved” yet aggressive style parenting exhibited by Hmong parents is in contrast to the “Tiger Parenting” model described by Chua (2011) in which Chinese parents in their overly strict and uncompromising parenting styles pressure their children to excel.

Concept 2: Career actualization. Career actualization for three out of four participants was triggered at a young age. Participant P1, classified as a 1.5x generation and who is a high school math teacher explained:

I helped my parents balance their checkbooks at a very young age because my parents were not educated. I could do math calculations mentally without writing it down, and this is what sparked an interest in mathematics for me as a child.

Participant P2, a second-generation Hmong-American, and a software developer described:

My interest in computers was sparked when I started playing video games as a child. The first time my computer broke, my family sought the help of a relative to fix it. By carefully watching my relative fix my computer, I was able to fix his computer when the problem surfaced again.

Participant P3, another second-generation Hmong-American, explained:

I learned how to fix stuff around the house, our cars, and in our gardens by watching and helping my dad with chores. I loved tinkering with stuff at a young age, and this is what led me to pursue an engineering career.

Gee (2003) explained that schools, workplaces, families, and academic researchers can learn a lot from video and computer games. The learning principles that good games incorporate are strongly supported by research in cognitive science. Gee (2003) expounds that in field studies conducted at the University of Wisconsin-Madison on seven-year-olds that played “Age of Mythology,” they were able to make connections between mythological figures and popular culture superheroes to history and society. Gee (2003) argued that this is education at its best, and is happening at home, outside of schools. Participant P2, the second-generation participant,

learned in this manner, and although he mentions that he was not particularly fond of math and physics, he loved computers and programming them. Participant P2 described:

All I know is that I've played a lot of computer games when I grew up. So, there was this time when my computer wasn't working, and I was like what's going on? I don't know. I got, I got to play my games.....And that's when my dad asked a relative to come fix my computer.

P2's passion for computer games from a young age is what steered him into pursuing a STEM-related career at a later age.

In another theme related to the concept of career actualization, all four participants mentioned that they were the first in their families to go to college. Their matriculation from college was a sense of pride not only for themselves but also for their families. Some participants revealed that they almost had a "chip on their shoulder" feeling as they navigated themselves through college. When their instructors and counselors doubted their abilities, participants felt an urge to push and study harder and, in a sense, try to prove them wrong. Participants also emphasized that their teachers were not negative, but they sensed that their teachers thought they could not do certain things. Specifically, participant P1 explained that his stubbornness made him accomplish those tasks that his teachers doubted he could do.

Participants also noted that they lacked immediate role models in STEM, although participants P1 and P3 mentioned that they did know of a distant relative who was employed in a STEM field. In a study conducted by Kricorian et al. (2020) of forty-eight subjects comprising of women of color and minority students pursuing STEM careers, 54% of subjects mentioned that meeting and being mentored in STEM by someone of the same gender and ethnicity would be very beneficial. Participant P3, in this study, very clearly explains that from what he

remembers in high school, most of the speakers at his graduation were business professionals, and there was a lack of STEM professionals speaking to them. Hence, virtual mentorship with STEM professionals provides an avenue to increase the underrepresented minority participation in STEM. It is evident from the narratives of the participants in this study that there was lack of role models of similar cultural backgrounds. This lack of cultural capital, in terms of role models, could potentially be a factor in why Hmong-Americans are not pursuing STEM careers.

Concept 3: Support systems. Support systems both economically and through institutional agents were pivotal in providing the much-needed social capital for all four participants to matriculate and pursue their STEM careers. Hmong-Americans like most Southeast Asians came to this country as political refugees after the culmination of the Vietnam War. They differ from Asian immigrants from China, Korea, Japan, and India who came to the United States as economic refugees and who were given entry because of their labor market skills. All Hmong-American participants noted that they were from a low socio-economic status (SES) and without financial help from various governmental agencies they would not have been able to pursue their educational aspirations. Participant P1, a 1.5x generation and a high school math teacher explained:

Gosh, how am I going to pay all these [college] bills.....my parents didn't make much money so I knew I wasn't going to be able to ask my parents to help me financially.....I was awarded a TIP grant, it was for minorities, first-generation minorities to go to college. I do not know if it's out there anymore.

Participant P2, a second-generation and a software developer, whose parents dropped out from high school narrated:

I got financial aid, and grants and stuff..... Pell grants and work-study. I wanted to do work-study as it related to what I wanted to do.....It was better than working in fast food when I was in high school. I did [work-study] while staying at home, so I didn't have to pay for room and board or whatever, and food, and stuff, it was all there at home.

These participant stories were aligned with Lor's (2008) research on Hmong graduates from the four-year University of Wisconsin system, who also stated that they did not come from wealthy families and that their parents' financial resources were not enough to put them through college. Participants in both studies described that their parents did not have any formal education or have high paying jobs. Fortunately, financial aid was granted to them, and they had to maintain good grades to keep being awarded financial aid. This structural force afforded them the required social capital to matriculate and enter into their respective STEM careers.

Participants described that key institutional agents such as faculty, counselors, and tutors helped them overcome structural barriers as they navigated their educational trajectories. For example, Participant P4, a first-generation Hmong-American, who came here along with his wife at the age of eighteen, and who possessed very limited English language skills stated:

This country is very helpful, and also the instructors at XYZ technical college are very helpful. They're very helpful for students, they show respect, and they do a good job to make sure the students do a good job in class.....every instructor is very helpful and they keep pushing you to the right direction. And if you confuse something, you not understand, then you can talk to them.

These findings are consistent with Museus and Mueller (2018) study, in which participants described that key institutional agents positively impacted their success. However, unlike Museus & Neville's (2012) findings of Southeast Asian students receiving holistic

support, this was not the case in this study. Participants explained that the faculty and counselors were not necessarily negative but not encouraging and persuasive enough towards them. In Museus and Neville (2012) Southeast Asians students received targeted support, holistically, from institutional agents such as counselors and staff because these students were put into these targeted programs. Participant P1, the high school math teacher explained:

In high school, a lot of my teachers were not negative, but there's like this sense that they didn't really want to encourage you or felt like I couldn't do certain things. And I guess I'm stubborn that way because when I feel that somebody, was in a sense telling me that I can't do something, I get stubborn and I choose to do that just to prove a point I guess.

The support the participants received from institutional agents definitely had some intergenerational underpinnings. First and 1.5x generations were more apt to seek out support, while the second-generation participants seem more complacent and chose to do the assigned work by themselves. This seems to suggest that participants from different generations experienced a transition or an acculturation from their immigrant culture to the dominant (U.S) culture in their educational trajectories. Sam and Berry (2016) explain that acculturation brings cultural change in both immigrants and non-immigrants. The change, however, is greater for immigrants. When immigrants maintain characteristics of their own culture, while also adopting characteristics of the host culture; an acculturation strategy known as “integration” starts to occur (Sam & Berry, 2016). The second-generation participants in this study demonstrated this integration more so than the first and 1.5x generation participants. Their complacency in being not willing to seek help from institutional agents and preferring to do things by themselves showed that they were starting to integrate into the host culture.

Concept 4: Overcoming challenges and barriers. In the concept of overcoming challenges and barriers, participants were always aware and made aware, albeit unintentionally by others, about their identities as minorities in terms of culture and language. Institutional agents such as counselors automatically enrolled second-generation participants into Asian clubs or tested them for ESL even though they spoke fluent English having been born in the United States. P3, a second-generation Hmong-American, an engineer explained:

The counselors in high school would put us in an Asian club. There was just an Asian club, not a Hmong club. So everybody's was in it, Laotians, Vietnamese everybody who was Asian, honestly, that didn't help us at all. Just kept us too comfortable in our zone. To me, that was a, I would say that was a deterrent. Stepping out and exploring other clubs.....I wish they would have taken me, you know, to the mechanics club or some other club.

Another theme that surfaced in this concept of challenges and barriers was the lack of good study habits. All four participants reported to having worked very hard while in school and at helping their parents when they were not in school. Both second-generation participants noted that they could have had better study habits while they were in school. The first and the 1.5x generation participants were academically more conscientious than their second-generation counterparts. S. Lee (2001) explains that like the first and 1.5x generation, many second-generation Hmong-Americans were expected to perform caring work (e.g., interpreting and driving) and household chores. She goes on to explain that in second-generation families, these role reversals is what leads to the weakening of parental authority. Portes and Rumbaut (1996) posit that the parental generation has not acculturated at the same rate as their children, hence there is a “generational dissonance” that occurs because the second-generation is neither guided

nor accompanied by changes in the first generation. S. Lee (2001) further explains and this was noticed in this study, too, that the second-generation are not rejecting their Hmong backgrounds, rather, they are trying to redefine what it means to be Hmong in the United States.

Finally, a theme on microaggressions was brought to light in this concept of barriers and challenges. Although the participants in this study never explicitly used the term “microaggression,” their narratives suggested that they experienced subtle racial invalidations by institutional agents. Sometimes their English language skills were questioned even though they were born in the United States, but because they looked “Asian.” In another instance, some institutional agents assumed that they were automatically good at mathematics fueling the modeling minority myth. Participant P4, the first-generation participant, who had limited English skills and who was great at math was questioned by faculty on his high test scores. This is what P4 narrated:

In electronics they use, like 80% for math to do something until they come out I'm not very good at English but my math, I'm very good at math. A first generation, like me in this country, if you took the class, then you do great, good job and some instructors complain a little bitsaying..... Your English is not good, but why you do so good at tests.

In comparison to Iannarelli's (2017) study, most of the microaggressions experienced by the participants in this study were not in the form of microassaults or microinsults but of the form of microinvalidations. Microinvalidations are exchanges that “exclude, negate, or nullify the psychological thoughts, feelings, or experiential reality of a person of color” (Sue et al., 2007, p. 274). Hence, institutional agents, subtly negated or minimized the participants' experiences as they journeyed through their educational careers.

Conclusions

Upon careful review and analysis of all the themes that surfaced from the narratives of the four Hmong-Americans STEM professionals that participated in this study, a grounded theory generated, suggests that Hmong-Americans lacked the necessary cultural and structural forces to pursue STEM careers. These cultural and structural forces were not mutually exclusive of each other but interacted with each other in complex ways, shaping the educational trajectories of Hmong-American participants studied. This study yielded four overarching concepts: (1) parental influences on academic success (2) career actualization (3) support systems and (4) overcoming challenges and barriers.

Parents played a pivotal role in influencing all the participants. This cultural force of parental influence for the Hmong participants differed from that of the Tiger parenting model described in the review of literature for other Asian-Americans. Participants felt obligated to their parents to succeed in school. They had all heard about the hardships their parents encountered while in Vietnam and upon immigrating to the United States. Their parents pushed them to go to college and viewed education as a means to upward social mobility and desired for their children to have a good quality of life.

However, their parents did not choose their STEM majors or careers for them. For most of the participants their choice of STEM career was triggered at young age. Triggers such as computer games, helping their parents fix things around the home, and watching relatives fix things like computers were mentioned. All participants noted that they were good at mathematics. There was no generational divide in terms of mathematics, but there were differences in their English language proficiency. Generation 1.5x and second-generation participants demonstrated a good command over the English language and seem to have

acculturated as a faster rate than the first-generation participant. There was also a generational divide in terms of study habits. Second-generation participants noted that they had poor study skills compared to the first and the 1.5x generation. This generational difference in the participants study habits did not have an effect on their matriculation.

All the participants in this study were the first in their families to go to college. They worked hard and persevered because they did not want to fail. They knew of many fellow Hmong students who struggled to complete their STEM degrees and ultimately had to drop out. Participants did not want to end up like them. They would have been served better if they had role models and mentors in STEM, although, some did mention knowing a distant relative being either an engineer or a teacher. This lack of cultural capital, in terms of role models and mentors was expressed by the participants. The community as a whole did not significantly influence their decision to pursue their degrees, but it was primarily their parents that pushed them to pursue an education mostly to achieve financial security.

Educational institutions were the structural forces that impacted the participants to varying levels. Participants talked about the supportive nature of institutional agents and the helpfulness and the respect they received. Faculty, counselors, staff, tutors, and peers positively impacted our participants in their journeys and provided them with the necessary social capital needed for them to be academically successful. However, some participants also remarked that faculty and counselors were not necessarily negative but were not really persuasive and encouraging to them. This finding differed from the holistic support cited by Museus and Liverman (2010) on high performing institutions on the success rates of Southeast Asian students.

Participants also described that they encountered subtle racialized invalidations, more commonly known as microaggressions as they traversed their educational journeys. They were treated as being foreign and non-US citizens. Assumptions that stereotyped them, and that placed them into the larger panethnic grouping of Asian-Americans fueled the model minority myth.

Participants in this study were all from low socioeconomic backgrounds. Their parents not having a formal education, had low paying jobs, and could not support them financially. Governmental assistance in the form of financial aid, grants, scholarships, and welfare assistance played a significant role in helping them earn their STEM degrees. Participants expressed great appreciation for the benefits and support they received from federal and state programs. The findings suggested that financial assistance was critical to the participants' matriculation.

Recommendations

This research study has several important implications for further research and practice. The following recommendations are offered to increase the representation of Hmong-American students in STEM fields.

1. Participants described that the four concepts of parental influence, career actualization, support systems, and overcoming challenges and barriers greatly influenced their STEM educational trajectories. The participants possessed a generational diversity among themselves, which helped paint a broader picture of their educational journeys, but yet this study is not generalizable to all Hmong-Americans. Hence, a quantitative study, specifically at the same technical college as this study or a technical college with a high concentration of Hmong-Americans in Wisconsin, is warranted to study why an underrepresentation in STEM careers persists.

2. The findings of this study suggest that second-generation Hmong-Americans are acculturating to the dominant U.S culture at a faster rate than the first and the 1.5x generation. Even so, it would help if policymakers and institutional agents incorporate a culturally relevant curriculum that infuses Hmong culture and history in STEM-related courses in high schools that have a large concentration of Hmong students. S. Lee (2001), in her study of a high school in Wisconsin, explains that second-generation Hmong students found the content of their classes simply boring. They craved a curriculum that focused on their culture and history, and the students asserted they would take any class that taught them about Hmong culture, history, and the Hmong language. These types of culturally relevant interventions could also help close the achievement gap and help level the playing field in terms of academic success for Hmong-American students.

3. Hmong-Americans enrolled in STEM majors have a low persistence rate, and men have a lower persistence rate than Hmong women (Yang, 2017). The findings from this study suggest that there is a lack of role models in STEM for Hmong men to look up to. Research suggests that minorities and women of color would benefit a great deal by being mentored by someone of the same gender and ethnicity. However, given the scarcity of female and minority professionals in STEM, institutional agents and policymakers should incorporate professional STEM networks that utilize virtual mentorship models and preferably even one-on-one mentorship to encourage students to pursue and persist in STEM careers.

4. Also, it is vital for high school teachers and college faculty and staff to consider ways to engage not only Hmong students but also their parents to foster success in their STEM education processes. By educating both the parents and the students about career options in STEM, the parents and the students can collectively make decisions about their

STEM trajectories. This will also help in getting the immigrant Hmong parents to acculturate, and ultimately integrate at almost the same rate as their children, and get them involved in their child's educational aspirations.

5. Finally, educators need to educate themselves about microaggressions. The participants indicated that they experienced subtle microinvalidations as they journeyed through their high school and college careers. As the review of the literature suggests, microaggressions are often unintentional, and individuals that experience them do not realize that they are being offended or hurt. However, microaggressions, over a period of a person's career, can have a lasting effect and can be toxic. Microaggressions are rooted in xenophobia and could depress STEM confidence in minority students. Providing faculty and staff with professional development opportunities on the topic of microaggressions and how to have open and honest communication with minority students and students of color could prove to be very beneficial in recruiting and retaining them in STEM related programs.

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Appendix A: STEM Enrollment Data All WTCS Districts

<u>Ethnicity</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>Total</u>
Am. Ind/ Alask. native	122	106	102	111	112	112	113	110	121	103	121	104	93	85	102	105	1722
Asian	257	247	254	267	318	396	390	387	394	450	503	514	503	535	551	535	6501
Black	427	358	389	436	518	564	573	659	608	600	707	628	647	570	623	549	8856
Hispanic	289	257	298	318	357	447	489	545	525	564	679	712	768	818	862	906	8834
Multiple						49	85	113	124	155	197	192	198	238	252	231	1834
Pacific Islander	1	4	9	8	11	9	8	6	8	7	7	8	10	12	11	11	130
Unknown	259	231	272	349	453	376	385	372	378	386	427	456	449	474	409	394	6070
White	8835	7598	7494	7875	8391	9586	9383	9342	9197	9130	9308	9178	8526	8647	8608	8156	139254
Total	10190	8801	8818	9364	10160	11539	11426	11534	11355	11395	11949	11792	11194	11379	11418	10887	173201

Source: <https://tableau.wtcsystem.edu/#/views/ProgramPerformanceDashboard/ProgramPerformanceDashboard?:iid=1>

Appendix B: STEM Enrollment Data at NTC

<u>Ethnicity</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>Total</u>
American Indian/ Alaskan native	10	9	6	9	5	11	9	12	13	13	18	13	10	9	5	13	165
Asian	27	26	35	37	46	68	72	68	78	83	98	114	99	99	97	91	1138
Black	2	3	4	7	11	11	14	20	18	10	20	20	27	23	16	15	221
Hispanic	3	4	7	5	11	13	15	18	17	25	30	31	35	39	43	49	345
Multiple									3	6	5	7	12	16	8	10	18
20	22	127															
Pacific Islander				2	2	1	1	1		1	1	1	2	1			13
Unknown			3	2	13	33	55	53	68	68	81	82	78	92	66	56	750
White	1001	793	731	780	845	954	1045	1050	1036	1001	1116	1135	1052	1033	982	982	15536
<u>Total</u>	<u>1043</u>	<u>835</u>	<u>786</u>	<u>842</u>	<u>933</u>	<u>1094</u>	<u>1217</u>	<u>1227</u>	<u>1237</u>	<u>1213</u>	<u>1380</u>	<u>1404</u>	<u>1313</u>	<u>1314</u>	<u>1229</u>	<u>1228</u>	<u>18295</u>

Source: <https://tableau.wtcsystem.edu/#/views/ProgramPerformanceDashboard/ProgramPerformanceDashboard?:iid=>

Appendix C: Number of Employees in STEM Manufacturing

Job Type		2007	2008	2009	2010	2011	2013	2014	2015
Professionals:	White	35980	41592	39150	38328	39844	3082	3486	3428
	Asian	1358	1823	1787	1777	1878	109	118	126
Technicians:	White	16503	19311	15938	15528	16260	1843	1876	1845
	Asian	309	517	359	404	434	51	68	78
Mid-level Officials:	White	28454	30192	28188	27788	28319	4579	4842	4629
	Asian	396	476	422	425	469	69	89	84

Note: Source: United States Equal Opportunity Commission (2019)

Appendix D: IRB Approval from Northcentral Technical College (NTC)



Real Life. Real Learning.

March 23, 2020

Dear Frank:

Northcentral Technical College has approved your request to conduct research at NTC. As a part of the procedure for Institutional Review of Research Activities, a committee consisting of the following individuals has approved your request:

Dr. Lori Weyers, President
 Dr. Jeannie Worden, Executive Vice President – Student Services and Regional Campuses
 Dr. Vicki Jeppesen, Vice President of College Advancement
 Dr. Darren Ackley, Vice President for Learning (abstained)

Northcentral Technical College external research guidelines state the following:

- Northcentral Technical College's name will not appear as linked to data collected unless further written consent is given by the President of NTC.
- Participant identities and individual information will remain confidential.
- Data and information collected will be stored securely.
- The researcher will provide a copy of the research results and final document upon conclusion of the study or the publication of the document.

Research results will be shared with the Executive Leadership Committee when complete. Please provide results back to Vicky Pietz (pietz@ntc.edu)

Please contact the Academic & College Effectiveness department if you have any questions.

Sincerely,

Lori Weyers
 President
 Northcentral Technical College

Vicky Pietz
 Dean, College Advancement/Special Projects
 Northcentral Technical College

APPENDIX E: IRB approval from UW-Stout



Office of Research and Sponsored Programs

101 Vocational Rehabilitation
University of Wisconsin-Stout
Menomonie, WI 54751-0790

Phone: 715.232.1126

May 12, 2020

Frank Fernandes
Teaching, Learning, and Leadership
University of Wisconsin-Stout

RE: The underrepresentation of Hmong-Americans in STEM careers

Dear Frank,

The IRB has determined your project, *"The underrepresentation of Hmong-Americans in STEM careers"* is **Exempt** from review by the Institutional Review Board for the Protection of Human Subjects. The project is exempt under **Category #2** of the Federal Exempt Guidelines. Your project is exempt for 5 years from **May 12, 2020**. If a renewal is needed, it is to be submitted at least 10 working days prior to the approvals end date. Should you need to make modifications to your protocol, [please complete the modification form](#).

Informed Consent: All UW-Stout faculty, staff, and students conducting human subjects' research under an approved "exempt" category are still ethically bound to follow the basic ethical principles of the Belmont Report: 1) respect for persons; 2) beneficence; and 3) justice. These three principles are best reflected in the practice of obtaining informed consent from participants.

If you are doing any research in which you are paying human subjects to participate, a specific payment procedure must be followed. Instructions and form for the payment procedure can be found at <http://www.uwstout.edu/rs/paymentofhumanresearchsubjects.cfm>

If you have questions, please contact the IRB office at 715-232-2691, or buchanane@uwstout.edu, and your question will be directed to the appropriate person. I wish you well in completing your study.

Sincerely,

A handwritten signature in black ink, appearing to read "E. Buchanan".

Elizabeth Buchanan
Interim Director, Office of Research and Sponsored Programs; Human Subjects Protections Administrator,
UW-Stout Institutional Review Board for the Protection of Human Subjects in Research

CC: Mooney

Appendix F: Informed Consent

UW-Stout Implied Consent Statement for Research Involving Human Subjects

Consent to Participate In UW-Stout Approved Research

Project Title: The underrepresentation of Hmong-Americans in STEM careers

Description:

This study utilizes a qualitative methodology to answer the research question as to what factors influence the research participants who are currently engaged in STEM (Science, Technology, Engineering, and Mathematics) careers to pursue STEM careers. This study will answer the overarching question: What factors have influenced Hmong-Americans who are currently engaged in STEM-related careers to pursue STEM careers? Participants will be given a choice of participating in this study by face to face interviews or by videoconferencing and will be informed that the interviews will be recorded. A Narrative Inquiry and a grounded theory approach will be utilized to uncover why this underrepresentation is occurring. Participant

descriptions will be analyzed for emerging themes to the factors influencing STEM career engagement.

Risks:

There is minimal risk associated with this study. Questions have been prepared and reviewed for participants to tell their stories as to what influenced them to pursue a STEM career.

Benefits:

Implications from this study's findings should not only inform but also help broaden participation for future Hmong students in the high demand STEM fields.

Confidentiality:

Once the analysis is completed, electronic copies of the interviews will be encrypted and stored on a USB device, which will be placed in a locked drawer in the researcher's home office. Any written documentation will be destroyed by shredding and subsequent disposal.

Future Use:

Any information collected for this research project will be stripped of identifiers and will not be used in other research in the future.

Time Commitment:

Participation will involve either a face to face interview or a video-conference, based on your preference and availability. The interview will be audio taped and take approximately 60 – 90 minutes to complete.

Right to Withdraw:

Your participation in this study is entirely voluntary. You may choose not to participate without any adverse consequences to you. You have the right to stop the interview at any time. However, should you choose to participate and later wish to withdraw from the study, there is no way to identify your anonymous document after it has been turned into the investigator.

IRB Approval:

This study has been reviewed and approved by The University of Wisconsin-Stout's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by federal law and University policies. If you have questions or concerns regarding this

study, please contact the Investigator or Advisor. If you have any questions, concerns, or reports regarding your rights as a research subject, please contact the IRB Administrator.

Investigator:

Frank J. Fernandes

Fernandesf5571@my.uwstout.edu

Advisor:

Dr. Carol Mooney

Mooneyc@uwstout.edu

Statement of Consent:

By signing this consent form you agree to participate in the project titled

“The underrepresentation of Hmong-Americans in STEM careers”

IRB Administrator

Elizabeth Buchanan

Office of Research and

Sponsored Programs

101 Vocational

Rehabilitation Bldg.

UW-Stout

Menomonie, WI 54751

715.232.2477

Buchanane@uwstout.edu

Print Name

Signature

Appendix G: Interview Questions

1. Could you tell me about your current occupation?
2. Tell me about your work history in chronological order, starting from your first job to your current job.
 - What did you like about these jobs?
 - Are there things you would have liked to have done differently?
3. What inspired you to pursue a STEM career as you were growing up? Do you remember any specific instances during your childhood that might have sparked an interest in STEM?
4. From a cultural perspective, are there aspects of your culture that influenced you to pursue this STEM career?
5. Did your parents influence your decision of pursuing this STEM career? If so, how?
6. Was education emphasized at home while you were growing up? Explain.
7. Did any other family members like siblings, cousins, aunts, or uncles influence your choice of career? If so, explain
8. Were there any community influences that helped influence you to choose this career?
9. Did a teacher, counselor, staff member have any influences on your STEM career choice?
If Yes, explain how?
If No, explain how or what could they have done differently?
10. Were there any barriers or impediments in the school/college environment to your pursuing this STEM career?
 - How did you overcome these barriers or impediments?
11. What were the economic factors that helped or hindered you along this STEM educational journey? (ex: financial aid, grants, tuition re-imbursment, governmental assistance, scholarships etc.)
12. Is there anything else you would like to add?