THE CREAM OF THE CROP:

NARRATIVES OF EAST INDIAN ENGINEERING GRADUATE

STUDENTS IN A UNITED STATES UNIVERSITY

by

Lynn Elaine Cozort

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

ARIZONA STATE UNIVERSITY

December 2007

UMI Number: 3287926

INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy
submitted. Broken or indistinct print, colored or poor quality illustrations and
photographs, print bleed-through, substandard margins, and improper
alignment can adversely affect reproduction.
    In the unlikely event that the author did not send a complete manuscript
and there are missing pages, these will be noted. Also, if unauthorized
copyright material had to be removed, a note will indicate the deletion.

UMI®

UMI Microform 3287926

Copyright 2008 by ProQuest Information and Learning Company.

All rights reserved. This microform edition is protected against

unauthorized copying under Title 17, United States Code.

ProQuest Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

THE CREAM OF THE CROP:

NARRATIVES OF EAST INDIAN ENGINEERING GRADUATE

STUDENTS IN A UNITED STATES UNIVERSITY

by

Lynn Elaine Cozort

has been approved

October 2007

Graduate Supervisory Committee:

Eric Margolis, Chair
Joanne B. Bauman
Alfinio Flores
Alex J. Molnar

ACCEPTED BY THE GRADUATE COLLEGE

ABSTRACT

A perceived threat that the United States (US) will not be able to compete globally because of a lack of engineers has been fueled by text and television reports that India is graduating substantially more engineering students than the US. This study is a narrative inquiry into the personal educational experiences of 18 mechanical and aerospace engineering graduate students at Arizona State University who are citizens of India. Capturing the personal educational experiences of participants provides a context absent from much of the research regarding the number of engineering graduates in India thereby complementing studies that have been performed. Data was gathered using oral history interviews. Techniques borrowed from grounded theory regarding collection and analyses of data were employed for the purpose of uncovering recurring themes. Six themes emerged from the data. These themes were utilized as concepts and labeled: Personal Identity; Competition; US; Education; Culture; and Future. Episodes that were common among research participants and substantiated by outside sources were analyzed for their plot potential, elevated from concepts to categories, and descriptively labeled: The Cream; The Safety Net; Tuitions; The Process; IIT, and US. The primary focus of this research involved an anecdotal case: East Indian engineering graduate students in mechanical or aerospace engineering at ASU. Their stories were retrospective in that they reflected on their school experiences beginning in kindergarten, and temporal, ending with their plans upon completion of their graduate degrees. Thus analysis of narrative was the method utilized to create the plot. The personal stories presented are intended to allow the reader to bring their own perspectives and raise questions in their own minds. The

study suggests that engineering students from India view the US educational system as superior; yet we are determined to go down a path of teacher-centered, rote memorization, high-stakes testing; the same path students from India are trying to escape.

iv

To Jason

Never give up your dreams.

ACKNOWLEDGEMENTS

First, I would like to thank my wonderful husband for all of your love, support and advice. I could not have done this without you.

My study would not have been possible without my participants. So, thank you to all of my participants for sharing your personal experiences. I learned a tremendous amount about each one of you and about India. Your willingness to speak with me so openly was an enjoyable and valuable experience; an experience that will stay with me forever.

Thank you Dr. Margolis, without your encouragement and guidance I would not have been able to achieve my goal of obtaining a doctorate degree. I am greatly indebted to you for taking me under your wing. From the first time I met you, as my qualitative research professor, I had the utmost respect for you. I have learned so much from you and I cannot thank you enough for your insightful contributions to my research and for everything you have done for me.

Thank you Dr. Flores for providing me with confidence. I learned a tremendous amount from having you as a professor in my math ed classes. But the greatest lessons learned came from your kind encouragement; you believed in me and you have encouraged me to believe in myself. I have the greatest respect for you and you have had a tremendous impact in the field because of your intellectual contributions and the lives you have touched.

Dr. Bauman, thank you for all of your support and encouragement. Your enthusiasm for life is contagious. I greatly admire all that you have accomplished and I cannot thank you enough for the experiences we have shared.

I must acknowledge my sister for the numerous hours of technical assistance and listening to me. Thanks for always being there.

I would like to thank Dr. Anijar for teaching me to see things differently. You laid the foundation and never let me give up. The lessons I have learned from your classes and your mentorship will stay with me throughout my life.

I also want to thank Dr. Barone, I learned so much from your classes. My research and my dissertation would not have been the same without your contributions as my professor in several research and curriculum courses.

And I want to thank all of my friends and family for always just being who you are. You are all so special and this doctoral journey for me would not have taken place without your support and encouragement through every step.

PROLOGUE

It was September, 2006 in Arizona. Although it was still warm outside, a friend of mine who is a Professor in Mechanical and Aerospace Engineering (MAE) at Arizona State University (ASU), offered to buy me a cup of coffee. We returned to my office, sipped coffee, and chatted, as we often did, about life and we exchanged philosophical ideas about teaching or whatever topic our conversations would lead us to. This particular day, as he was leaving my office, he asked me: "Have you read the book *The World Is Flat* by Thomas Friedman?" I responded that I had not and he said "you should read it." I made a note of the title and author on a yellow Post-Note and set it aside. Life is busy being employed full-time and working on my PhD, so several weeks had gone by and I had not given the book another thought. Then, déjà vu; one of the PhD students in the Department stopped by and we were engaged in conversation, as usual, but when he was ready to leave my office he stopped and asked: "Have you read the book *The World Is Flat?*" Again, I responded that I had not and he said "you should." I was slightly more interested since this was the second time the book was brought to my attention but I had not purchased the book. I taught mathematics at a high school in Scottsdale, Arizona for nine years and for five of those years I was also the Math Department Chair. Therefore, education, mathematics and engineering are areas that interest me, and probably the reason *The World Is Flat* had been brought to my attention.

A few more weeks had gone by when I was invited to attend a workshop regarding "Service-Oriented Architecture and Applications" which was an interdisciplinary initiative by the School of Engineering, the Technology Based Learning and Research Group, the College of Education and the Business School at ASU. The

primary focus was how information technology jobs have changed and what types of high school and undergraduate computer science education will be required to accommodate current and future job markets. I thought that sounded interesting so I completed the registration form and attended one of the two-day sessions. When I arrived I saw several people that I knew from the Scottsdale Unified School District so we exchanged greetings and settled down into our chairs waiting for the workshop to begin. I was reviewing the handouts that we received when I noticed that one of the cited references was, yes, *The World Is Flat*. I thought okay, so now I have to read this book!

The next Saturday I purchased the book, I did not realize it at the time, but my journey toward my research was underway. After I finished reading the book, my curiosity was piqued regarding the competition from India for engineering jobs and I questioned the merit of what Friedman was saying; an internet search would be the next step. I read reports from the National Academies, Duke University, articles from the American Society for Engineering Education journal, Computerworld magazines, and several articles from other academic journals. Everything I read seemed to address the number of Indian engineering students; some articles focused on the growing number of engineering students from India, some articles disputed those numbers, but in whatever capacity, it was always about the numbers. Yet I kept wondering about the people behind the numbers. How can there be a complete picture without going beyond the numbers to learn about the people? How can decisions that may influence the education of our students be made without some qualitative data to enhance the quantitative data? How did the educational experiences of Indian students shape their decision to pursue engineering?

ix

Those questions would ultimately guide my dissertation research. However, my own life experiences also influenced my research and therefore sharing some of my personal background regarding how I got to this point is useful. In 1982 I was hired by the MAE Department at ASU as the Office Manager. My position as Office Manager was a full-time job, but I wanted to learn about things so I began to take classes during my lunch hours. Keeping up with homework while working full-time and raising a family was quite challenging but I persevered. Soon my lunch-time classes turned into a degree-seeking program and I decided that I wanted to become a teacher. But, what would I be interested in teaching? I had excellent computer skills and I enjoyed training my staff on the latest software packages, so teaching computer programming in a high school seemed to be the obvious choice. But wait a minute, in order to teach computer programming there were only two paths I could take – mathematics or business. I had been employed in business for almost 20 years and seeking a business degree seemed quite boring. But math? I can't do math! My friend, the MAE Department Chair, in his kind way tried to convince me that if I could do computer programming, then I could certainly do math. I viewed math and computer programming as two completely discrete objects, no relationship at all existed in my mind; but what else would I do? So, with a lot of help and patience from my engineering friends, I realized that yes, as a matter of fact I *could* do math. In 1994 I completed my Bachelor's degree in secondary education with an emphasis in mathematics and left MAE to teach high school math. Believe it or not, I was actually hired as the honors calculus teacher, good grief!

x

I loved teaching high school math and my struggles with mathematics gave me a perspective that allowed me to understand students who have difficulty being successful in mathematics. I began to take classes toward my Masters degree during the evenings and summer sessions; but I have to admit that my motivation for pursing an MS degree was not borne from curiosity. Rather, at that time there was an Arizona Board of Education requirement that teachers must receive their Masters degree within seven years from the date of the original teaching certificate to be able to maintain their teaching certificates. I successfully accomplished that goal and the very next year, in addition to teaching, I became the Math Department Chair at the high school. The first year as Chair was a learning experience indeed. However, by my third year as Chair I realized that working with the entire student body, parents, colleagues, and administrators at the high school as well as the school district, provided an opportunity to touch the lives of a larger number of students than the 150 students per year I had as a teacher. Thoughts of pursuing a PhD began to enter into my mind. Helping students be successful in mathematics has been my primary focus throughout my educational career. I started thinking that maybe with a doctorate degree I would be able to reach an even greater number of students; perhaps through curriculum development or other educational entities. Around the same time that I was tossing around the idea of becoming "Dr. Lynn" a position as the graduate student advisor became available in, of all places, the MAE Department at ASU.

So, after five years as Math Chair and nine years as a teacher, I left the high school and returned to the engineering territory I knew so well. I am still employed full-

xi

time as the graduate advisor; however, because of my extensive experience in MAE, I have assumed additional roles and thus I now have a title of Coordinator, Sr. However, it is my role as graduate advisor that allows me to work with graduate students from all over the world. In engineering, the largest number of international students are from India. I have a special relationship with all of the MAE graduate students; my office is filled with culturally-specific items students have brought me as thank-you gifts from around the world. My relationship with the students is special in part because I am not only the person who helps them navigate their way through Departmental and University policies and procedures, but I am also "one of them"; I am a PhD student, and in that capacity we have shared experiences. As a result students stop by my office continuously throughout the day and we are constantly chatting. What begins with a business question or discussion, during which time I am wearing my advisor hat, invariably leads to putting on my student hat as we discuss our research or any other topics that surface.

Investigating the educational experiences of graduate engineering students from India seemed a natural fit for pursuing my research and addressing the questions that had surfaced from my initial readings. After all, I work with Indian engineering graduate students every day, I have a background in mathematics education, and I wanted to know what lies behind the quantitative reports regarding the number of engineering graduates from India; I wanted to explore their personal histories. Therefore, the quest to pursue a qualitative study of Indian engineering students had begun.

Chapter One provides an overview of my research; I address the purpose and significance of my study as well as my intended audience. In Chapter Two I present

information regarding my research methodology and the methods I employed. Chapter

Three provides an introduction to my key participants and my constructed narrative

regarding the educational experiences of engineering graduates from India who are

pursuing graduate degrees at ASU. Chapter Four provides additional insight regarding

education in India. Chapter Five presents my final thoughts regarding education,

engineering, and mathematics education. My literature review was meaningful in four of

the five chapters; therefore I elected to weave my literature review throughout the text

rather than separate it as a discrete chapter.

TABLE OF CONTENTS

CHAPTER ONE

Introduction

Purpose of the Study

The purpose of my research is to raise questions in readers' minds; it is not intended to represent an omnipotent interpretation of the data. Readers should allow their personal histories to influence how they interpret the story that I constructed from my research. I invite readers to "imagine their own uses and applications" (Clandinin & Connelly, 2000, p. 42) of the data. I believe that individual experiences are a valuable resource and that what my participants had to say is important; that their stories are worthy of being interpreted and presented because:

> Life by its very nature is dialogic. To live means to participate in a
> dialogue: to ask questions, to heed, to respond, to agree, and so forth. In
> this dialogue a person participates wholly and throughout his whole life
> (Bakhtin, 1984, p. 293).

Capturing the personal educational experiences of my participants provides a context absent from much of the research regarding the number of engineering graduates in India thereby complementing studies that have been performed and documented. While the presented story represents my own interpretation of the data, "it is always possible to argue for or against an interpretation.... The text speaks of a possible world and of a possible way of orientating oneself within it" (Ricoeur, 1973, pp. 108-114).

Significance of the Study

My study presents Indian engineering students from a different perspective than what has been previously documented because I examined the educational situation in India by utilizing data that stems directly from some students who have experienced it. There is tremendous potential regarding the "larger questions of social significance" (Clandinin & Connelly, 2000, p. 42) and my research will generate inquiries to lay the foundation for future studies. Ideally, it will serve to provide those who are concerned with curriculum issues complementary information that will address more than just the numbers.

For many Indian engineering graduates, obtaining a Masters or Doctoral degree in the United States (US) can ensure their success as a professional engineer in India. Additionally, if they are able to secure employment in the US upon graduating, they enhance their opportunities to secure a better engineering job at home; a job that is more intellectual than technical, a job that is more thinking than one that is out in the field performing engineering tasks. In India, "admission to a top American research university is considered by many families the highest achievement" (Selingo, 2007, ¶ 11). During the Fall 2006 semester at Arizona State University (ASU) 36 percent of all engineering graduate students had US citizenship; 31 percent had Indian citizenship; and 13 percent had citizenship in China. Kamdar (2007) indicated that this is not an unusual trend nationwide:

> For the last several years, India has consistently sent more students to
> study in the United States than any other country. In 2005, over eighty

thousand students from India came to the United States for higher

education (p. 28).

Many US research universities actively recruit international students; for example, on a

recent trip to India, Dr. David J. Skorton, President of Cornell University, admitted to

reporter Jeffrey Selingo "that foreign students, and those from India in particular, are the

lifeblood of any American research university. 'We depend on international students as

research assistants and teaching assistants' he says." (Selingo, 2007, ¶ 22). There is much

more to the highly competitive quest to become a professional engineer than just the

reported and controversial numbers. Kamdar (2007) explained:

> India is a severely hierarchical society, in which a caste system orders
>
> human beings from inferior to superior rank and allots them specific roles.
>
> India's caste hierarchy bleeds into every aspect of Indian society....
>
> Indians are among the most status-sensitive people in the world. Rank is
>
> important in India and dictates the minutiae of social interaction.... High
>
> status Indians enjoy certain privileges and a certain lifestyle, and low-
>
> status Indians do without, and many in both groups accept this as the
>
> natural order (p. 232).

Intended Audience

Concerns regarding the number of engineering graduates from India and the

ability of US students to compete have been addressed in a variety of text and media

forms. Researchers from Duke University published data that disputed the reported

numbers of Indian engineering graduates (Gereffi & Wadhwa, 2005); there have been published political documents from the National Academies ("Rising Above the Gathering Storm", 2006) as well as Congress and the President of the US ("American Competitiveness Initiative", 2006). Additionally, the general public has been exposed to a perceived threat regarding the number of Indian engineering graduates through a best-seller book (Friedman, 2006), television (Klug & Flaum, 2006) and the internet. Therefore, my narrative is written with a broad-based audience in mind. I did not write the story in a manner that is appropriate only for researchers; it was written so that any individual interested in the personal educational experiences of engineering students from India will be able to become engaged. As a result, I designed my study in such a way that the participants' stories provided the central framework. My goal is to have my dissertation serve as a foundation for future writing; thus, planning for a broad audience provides flexibility for the direction of subsequent publications.

Background

Engineers are some of the most innovative thinkers in our society, thus when statistics and analyses are documented through multiple media sources indicating there is a growing threat to the engineering profession, those reports receive recognition. "Fortune " published an article in February 2005 stating that India will graduate 350,000 engineers but that the US will graduate only 70,000 engineers; that report set the stage for a growing concern that America is losing its competitive edge in an era of globalization (Colvin, 2005, ¶ 13). The reported numbers, as well as the hyperbole of the text, received

recognition when the National Academy of Sciences, the National Academy of
Engineering, and the Institute of Medicine, collectively referred to as the National
Academies, cited those numbers in a report titled "Rising Above the Gathering Storm,
Energizing and Employing America for a Brighter Economic Future" (2006). The number
of engineering graduates in India continued to draw attention as they were repeatedly
cited. The American Society for Engineering Education, "Newsweek", the "Philadelphia
Inquirer", the "Boston Globe" and other sources cited the celebrated number. The
accuracy of the reported 350,000 graduates has been debated but as Milo Schield (1999)
stated: "In some cases, a true statistic has been selected just because it supports a
particular claim – not because it is representative" (p. 3). Gerald Bracey (2006) reported:
"Statistics that end up as conventional wisdom even when they're wrong usually become
popular by being presented as fact in a highly visible and respected source" (¶ 10). And,
according to Diane Moody (2007):

> Statistics have an important role to play in assessing market performance.
> Too often, though, numbers are used more to make a splash than to
> enlighten, and upon closer scrutiny, the underlying analyses lack
> credibility (p. 57).

Sounding alarms regarding the state of US education and preparing students to
keep America globally competitive is not a new event. Talk of a crisis in education began
almost as soon as World War II was over. Life magazine October 16, 1950 was a special
issue titled "U.S. Schools They Face a Crisis". The successful launch of Sputnik I by the
Soviet Union in 1957 stunned the American public and generated an emphasis in

mathematics and science education. Life Magazine's cover for March 24, 1958 was also

about the crisis in education and compared a Russian and an American high school

student. The March 31, 1958 issue continued the theme with "Crisis in Education Part

II," emphasizing low teacher pay, overwork, and the lack of adequate equipment for

science classes. By the 1980s it was the Japanese we feared would overtake us. In 1983

the release of "A Nation At Risk: The Imperative for Educational Reform" raised

questions regarding mathematics and science education reporting that SAT scores were

steadily declining, that one-third of 17-year-old students could not solve math problems

involving multiple steps, that one-fourth of all four-year college mathematics courses

were considered remedial, and the Commission called for "increased support for the

teaching of mathematics and science" ("A Nation at Risk", 1983, ¶ 20). Nonetheless,

controversy surrounding the number of engineering graduates in India continues to be an

attention-getting phenomenon and has spurred action. Some representative examples

include: The National Science Foundation calling for STEM (Science, Technology,

Engineering, and Mathematics) components to be included in research proposals,

Margaret Spellings, the US Secretary of Education, traveled to India in 2006 for the

purpose of investigating their education system (Klein, 2006), Congress is investigating

ways to improve K-12 mathematics and science education in the US, and President Bush

generated the "American Competitiveness Initiative" (2006).

Public fears regarding America's ability to remain competitive have spawned

another round of concern regarding the current state of mathematics and science

education in the US. For example, the report prepared by the National Academies listed

four recommendations; the first recommendation calls to "increase America's talent pool by vastly improving K-12 science and mathematics education" (Rising Above the Gathering Storm, 2006, p. 5). President Bush's "American Competitiveness Initiative" aims to train "100,000 highly qualified math and science teachers by 2015" (2006, ¶ 4). I attended two seminars where Program Directors from the National Science Foundation spoke to young engineering faculty and stated that it will be difficult for them to obtain funding without a broader impact component directly related to outreach programs targeting pre-university grades. And, legislation has been presented that includes "measures to improve science and math teaching" ("Keeping America Competitive", 2006, ¶ 5). Regardless of whether the number of engineering graduates in India is accurate or exaggerated, curriculum issues are being examined by US federal government personnel, school administrators, educators and the general public because of the highly publicized concerns.

As I mentioned previously, reports regarding engineering competition from Indian graduates raised fundamental questions in my mind. Specifically, "Who are the people behind the numbers?" and "How have their educational experiences shaped their decision to pursue engineering?" Therefore, my research qualitatively examined the educational experiences of some Indian engineering students who are part of the reported 350,000 graduates.

CHAPTER TWO

Research Methodology and Methods

Qualitative versus Quantitative

The type of method employed for pursuing a research topic depends on the

purpose of the research. Strauss and Corbin (1990) refer to qualitative research as:

Any kind of research that produces findings not arrived at by means of

statistical procedures or other means of quantification. It can refer to

research about persons' lives, stories [or] behavior.... Qualitative methods

can be used to uncover and understand what lies behind any phenomenon

about which little is yet known. It can be used to gain novel and fresh

slants on things about which quite a bit is already known. Also, qualitative

methods can give the intricate details of phenomena that are difficult to

convey with quantitative methods (pp. 17-19).

Utilizing Strauss and Corbin's explanation of qualitative research, I determined that

pursuing a qualitative exploratory investigation, rather than a quantitative method would

be appropriate for my study because the goals of qualitative methods aligned with the

purpose of my research.

In general, the aims of quantitative studies are to test hypotheses and to establish

criteria that address concerns of validity, generality, and being able to replicate the study.

A well-defined problem is investigated for the purpose of obtaining a solution and/or

generalizing the investigated theory to a larger population. Quantitative research requires

that investigators have enough knowledge about the topic to design and articulate what

numeric or statistical procedures will be utilized to determine such things as variance and correlation. If surveys, questionnaires, or interviews are utilized to obtain data, questions and categories are developed prior to data collection that are narrowly defined and are restricted to specified topics. To reduce bias in a quantitative study, the categories and questions are designed to facilitate the use of mathematical measurement techniques which mandate that the questions be standardized and neutral, thereby suppressing individual stories and stripping them of personal and social contexts (Mishler, 1986). The goal of my study was to explore and learn from the participants' personal experiences; thus, designing standardized questions for interviews to obtain a computational value and inhibit the telling of their stories would defeat the purpose of my research.

> The standard approach to interviewing [in quantitative studies] is
> demonstrably inappropriate for and inadequate to the study of …
> how individuals perceive, organize, give meaning to, and express
> their understandings of … their experience, and their worlds (Mishler,
> 1986, p. ix).

Narrative Research and Grounded Theory Research Goals

My study was designed to learn from participants' oral histories and to provide a representative account of their stories in a research text that interprets their personal experiences. Therefore a narrative inquiry was appropriate. Research that is pursued "to describe findings within a particular situation" (Vaughn *et al.*, 1996, p. 16) is well suited for narrative. Narrative inquiry explores lived experiences and is told by participants in

storied form. Clandinin and Connelly (2000) stated that "education and educational studies are a form of experience," and for them narrative was the "best way of representing and understanding experience" (p. 18). However, my study yielded a large amount of data and a method for analyzing and identifying coherent themes was important to be able to understand and portray the participants' experiences in a research text. I employed techniques borrowed from grounded theory regarding collection and analysis of data for the purpose of uncovering recurring themes. In contrast with grounded theory methodology, I did not necessarily intend for the research to produce a theory of the schooling experiences of engineering students from India who are pursuing their graduate studies in the US.

Polkinghorne (1995) described stories as expressing "a kind of knowledge that uniquely describes human experience in which actions and happenings contribute positively and negatively to attaining goals and fulfilling purposes" (p. 8). Narrative research and grounded theory research are both qualitative methods that can investigate the stories of individual lives, human behavior, social constructs, educational experience, or any other phenomena of interest.

Qualitatively analyzing data to construct a theory is the central tenet for grounded theory research. "Grounded theory serves as a way to learn about the worlds we study and a method for developing theories to understand them" (Charmaz, 2006, p. 10). Interpretation is the key word that distinguishes theory from description. According to Strauss and Corbin (1990) "First, theory uses **concepts**. Similar data are grouped and

given conceptual labels. This means placing interpretations on the data. Second, the

concepts are related by means of **statements of relationship**" (emphasis in original,

p. 29). Grounded theorists are concerned with building theory directly from the data

gathered regarding the phenomena; they try not to impose theory onto the data.

> Formulating theoretical interpretations of data grounded in reality provides
>
> a powerful means both for understanding the world "out there" and for
>
> some measure of control over it.... One does not begin with a theory, then
>
> prove it. Rather, one begins with an area of study and what is relevant to
>
> that area is allowed to emerge (Strauss & Corbin, 1990, pp. 9, 23).

Grounded theorists allow for reader interpretation by creating theories that emerge from

their data which can lead:

> other scholars to new vistas. Grounded theory methods can provide a route
>
> to see beyond the obvious and a path to reach imaginative
>
> interpretations.... When born from reasoned reflections and principled
>
> convictions, a grounded theory that conceptualizes and conveys what is
>
> meaningful about a substantive area can make a valuable contribution
>
> (Charmaz, 2006, pp. 181, 183).

Narrative research involves story; generally there is a beginning, a middle and an

end with a thematic thread throughout the story:

> Happenings are drawn together and integrated into a temporally organized
>
> whole. The thematic thread is called the plot.... Plot is the narrative
>
> structure through which people understand and describe the relationship

among the events and choices of their lives. Plots function to compose or configure events into a story by: (a) delimiting a temporal range which marks the beginning and end of the story, (b) providing criteria for the selection of events to be included in the story, (c) temporally ordering events into an unfolding movement culminating in a conclusion, and (d) clarifying or making explicit the meaning events have as contributors to the story as a unified whole (Polkinghorne, 1995, p. 7).

I concur with Coles (1989) that for narrative researchers, "What ought to be interesting … is the unfolding of a lived life rather than the confirmation such a chronicle provides for some theory" (p. 22). When humans engage in activities that perceptually connect relationships to create a whole out of separate parts, they have created meaning. The meaning of each separate part is created by the contribution it played in generating the whole episode (Polkinghorne, 1988). Narrative researchers generally tend to effect meaning, their aim is not necessarily to expand knowledge in a given area of interest. Rather, they examine the relationship of events, and create a thematic plot which unites seemingly discrete episodes into an explanatory, and when done well, an interesting whole that is a story (Clandinin & Connelly, 2000; Polkinghorne, 1988, 1995).

Although interpretation and meaning are essential components of narrative research, I note that there are two types of narrative research. They have been identified several ways but the underlying foundations are the same. Polkinghorne, in his 1988 book referred to the two types as "descriptive" and "explanatory" (pp. 161-162), in his 1995 article he referred to Jerome Bruner's (1986) two types of cognition and described

narrative inquiry as "paradigmatic-type" and "narrative-type" (p. 5). More recently I have heard it referred to as "narrative analysis" and "analysis of narrative" which is the way I refer to narrative research in this writing. Deciding which method researchers should use depends on the purpose of the research. If the goal is to "produce an accurate description of the interpretive narrative accounts individuals or groups use to make sequences of events in their lives or organizations meaningful" (Polkinghorne, 1995, p. 16), narrative analysis is the appropriate method i.e., emic. If, however, the goal is to "account for the connection between events in a causal sense and to provide the necessary narrative accounts that supply the connections" (*ibid*), then analysis of narrative is utilized i.e., etic. The goal of my research was to identify connections between participant stories that provided the framework to generate a narrative plot, thus analysis of narrative was the method I employed.

Data Gathering Techniques

The purpose of my research was to qualitatively explore the educational backgrounds of engineering graduates from India and to learn from their personal experiences. Therefore, I decided that conducting oral history interviews would be the most appropriate method for gathering data.

Qualitative research data can be obtained through multiple methods such as personal interviews, questionnaires, videos, ethnographic methods, observations, photographs, and analyses of a variety of text as well as other forms of media. The type of data that is gathered also depends on the purpose of the research; researchers must ask

themselves questions about what they want to study, what they want their readers to get out of it, and why it is important, before they can determine which data gathering tool(s) will yield the information they seek. Research questionnaires can ask respondents to provide information through the use of short-answer questions, questions that have a numeric structure such as using a Likert scale, or free-response questions that provide respondents an opportunity to write paragraphs to explain their views. Regarding the three types of questionnaire inquiry structures Polkinghorne (1995) stated: "Although qualitative research can use all three forms of data, it is primarily characterized by its use in narrative form" (p. 6).

Qualitative data collected, whether for narrative or grounded theory research, are primarily characterized by the richness of the information they provide. Charmaz (2006) described rich data as being "detailed, focused, and full. They reveal participants' views, feelings, intentions, and actions as well as the contexts and structures of their lives" (p. 14). In general, qualitatively gathered data can be used in either a grounded theory or a narrative approach to research; the purpose of the research determines how the data will be utilized and thus the reason researchers must ask themselves questions about pursuing a phenomenon. For example, when researchers decide to incorporate an analysis of narrative method they collect stories to be used as their data. Polkinghorne (1995) divided storied data into two types based on temporality:

> Diachronic data contain temporal information about the sequential
>
> relationship of events. The data describe when events occurred and the
>
> effect the events had on subsequent happenings. The data are often

autobiographical accounts of personal episodes and include reference as to

when and why actions were taken and the intended results of the actions.

Synchronic data lack the historical and development dimension. They are

framed as categorical answers to questions put by an interviewer ... and

provide information about the present situation or belief of an informant

(p. 12).

Data for storied narrative can come from written sources, such as personal journals, but

are more commonly gathered through intensive interviewing that allows for extensive

exploration of the studied phenomenon (Charmaz, 2006; Mishler, 1986; Polkinghorne,

1995; Strauss & Corbin, 1990).

Data obtained through the use of textual material is classified by Charmaz (2006)

as either elicited text or extant text (p. 35). Elicited texts are written by the participants in

response to inquiries posed by the researchers. Elicited texts commonly include personal

journals, photo elicitation, written personal histories, free-response questionnaires and

internet surveys that allow for free writing. If the textual material does not involve

researchers inquiring about an experience or posing a question, the text is called extant.

Extant texts may include autobiographies, photographs, personal letters, government

reports, even internet chats (provided the researcher does not participate in the chat).

Elicited and extant texts may provide the primary, and in some circumstances, the only

source of material for an investigation; or, the texts may supplement interviews,

complement observations or facilitate in establishing credibility.

Interviews or questionnaires are utilized in narrative as well as other qualitative and quantitative inquiries; however, it is the structure that differs. Narrative allows participants to tell stories in their own way. Interviews are not confined to specific questions posed by the interviewer; rather, people have the freedom to describe experiences in a manner consistent with normal conversation. People do not have to learn how to tell stories; it is a skill developed during childhood and a natural way of communicating to convey meaning (Gee, 1985; Kemper, 1984). According to Clandinin and Connelly (2000), "oral history interviews are one of the most common interview formats in narrative inquiry" (p. 111). Polkinghorne (1995) concurred: "Interviews appear to be the most often used source of storied narratives in contemporary narrative inquiry" (p. 12). And, Charmaz (2006) stated that "intensive interviewing permits an in-depth exploration of a particular topic or experience and, thus, is a useful method for interpretive inquiry" (p. 25).

Participant Selection

The focus of my research involved engineering graduate students who have Indian citizenship and who are pursuing their graduate work in the US. Interviewing all Indian engineering graduate students in the US would not be practical, nor would it be productive. Therefore, as a matter of convenience, I selected Arizona State University (ASU) as my research site.

A query of ASU's data warehouse indicated that were 485 students with Indian citizenship enrolled as graduate students in 14 engineering majors at ASU during the Fall

2006 semester. While 485 Indian engineering graduate students at ASU would constitute a convenient bounded system, it would logistically be an unmanageable system for my research. I narrowed the boundaries to include 37 Indian students at ASU who are seeking graduate degrees in Mechanical or Aerospace Engineering (MAE). As previously mentioned, I am the academic graduate advisor in the MAE department at ASU and I have a well-established rapport with MAE graduate students. Thus I decided that the most significant contribution to my study would come from purposively sampling to select participants only from MAE. "Purposive sampling is a procedure by which researchers select a subject or subjects based on predetermined criteria about the extent to which the selected subjects could contribute to the research study" (Vaughn *et al.*, 1996, p. 58).

I considered involving engineering disciplines other than MAE, such as Computer Science, Electrical Engineering, etc., and I also considered the possibility of utilizing a cross-section to include several of the disciplines. However the rapport that I have established with MAE graduate students creates an environment that, as James Spradley (1979) said, "allows for the free flow of information" (p. 78). Encounters with participants in their daily lives, outside the interview situation, contributes to rapport and encourages them to openly discuss their experiences and their culture. "*Developing rapport* and *eliciting information*" are central to the ethnographic interview (emphasis in original, Spradley, 1979, p. 78).

I obtained approval from the Institutional Review Board (IRB) for my research and then I distributed an invitation to participate in my research study to 34 male and 3 female MAE Indian graduate students via e-mail (IRB application Appendix A). The e-mail included a description of the research, an expectation of the amount of time involved, stated that the interviews would be videotaped as well as audiotaped and explained storage of the data. My invitation informed the students that their participation in my research was voluntary; that they were under no obligation to participate, and that if they chose to become part of my research they could withdraw from the study or stop the interview at any time. Eighteen of the 37 potential participants volunteered to partake in my research study. Students who volunteered were given the required informed consent form that described my research, risks and benefits, informed them about confidentiality issues, notified them that there would be no incentive to participate in terms of financial gain and reiterated that they were allowed to withdraw from the study or stop the interview at any time without consequence. The students that volunteered also received a video consent form as required by the IRB. All 18 volunteers agreed and signed the forms that I have on file.

Upon completion of 18 interviews, transcription of the interviews, coding of the data, and data analysis, I realized that attempting to include the oral histories of all 18 participants in the constructed narrative was cumbersome and redundant. As a result, three participants were selected whose personal narratives were representative of the group of participants. I selected these three participants because they were the most articulate, they addressed a broader set of topics, and their personal narratives provided a

representative framework to facilitate the use of an analysis of narrative methodology. Or,

as Gubrium and Hostein (1998) stated:

> While we have argued that the coherence of lives and experience is always
>
> actively assembled, not just anything goes, interpretively speaking. To a
>
> significant degree, features of narrative practice may also be formally
>
> designated or constrained ... narrative control is asserted through what is
>
> properly tellable and how proper, accountable stories are to be told
>
> (pp. 173, 178).

Interviews

I conducted interviews on Saturdays or Sundays between 10:00 AM and 5:00 PM

in my ASU office. Each interview lasted approximately 90 minutes. I decided to hold the

interviews in my office for two reasons. First, my office is located on ASU's campus, a

convenient location for my participants and me. Second, and more importantly, daily

business transactions and conversations occur in my office, thus, it is a place where my

research participants and I are comfortable engaging in discussion. I thought that

establishing a comfort zone was critical because we would be discussing personal

experiences and as Clandinin and Connelly (2000) stated:

> The way an interviewer acts, questions, and responds in an interview
>
> shapes the relationship and therefore the ways participants respond and
>
> give accounts of their experience. The conditions under which the

interview takes place also shape the interview; for example, the place, the time of day, and the degree of formality established (p. 110).

I was mindful that the participants' familiarity with my office provided a relaxed environment; yet, meeting with students on a weekend, outside of normal business hours, for a purpose that was non-business related could affect the comfort zone. I was confident that I would be able to conduct the interviews so that the participants would feel at ease and that they would be able to speak freely regarding their personal experiences; thus, I did not believe that conducting pilot, or practice interviews was necessary. However, conversations during business hours have a different structure than a research interview. The conversation in a research interview is not the reciprocal interaction of two equal partners. There is a definite asymmetry of power. The interviewer defines the situation, introduces the topics of the conversation, and through further questions steers the course of the interview (Kvale, 1996, p. 126).

Regardless of how well established my relationship with the students appeared to be, in a different environment, such as an interview situation, the relationship may be stressed. Spradley (1979) posited that rapport will go through four sequential stages: "apprehension," "exploration," "cooperation" and "participation." As soon as I turned on the recorder, some of the students being interviewed, as well as myself, were somewhat apprehensive because none of us knew what to expect. However, I kept my participants engaged in conversation about their families and their home states which helped to reduce the anxiety. All of the participants explained their home states in detail, and many of the descriptions resulted in several pages of transcription.

After a few minutes the apprehension subsided and we began to explore our new relationship through verbal and non-verbal communication. As the comfort level increased, my participants began to ask me questions and our exploratory relationship gave way to a more relaxed situation. Seventeen of the interviews transitioned into Spradley's fourth stage of participation which is characterized by full engagement and interaction between the interviewer and interviewee. The students being interviewed asked me questions such as "have you heard of this?" and "have you been there?" etc.; they freely provided information regarding the Indian culture as well as reflecting on their personal experiences. For example, one of my female participants and I were engaged in a discussion regarding girls pursuing engineering in India. She stated:

> For girls it is like, you know India, it's not the same as you have in the US
> ... I've always got what I wanted so I'm more of a, you know, pampered
> child but for girls it is hard in India you know ... I mean it's not only
> mechanical engineering, as far as engineering is concerned the normal
> criteria in India is like girls studies and gets married and sees a family,
> that's it (Mrunalini).

However, one interview did not move beyond Spradley's exploratory stage; that student remained apprehensive and reserved. Some of his responses were descriptive but most of his answers were short, to the point, and only addressed specific questions that I posed to him. I am not sure why, but we were not able to establish the relaxed, conversational type of interview situation I had experienced with the other students.

Prior to turning on the video and audio recorders to begin the formal interviews, I explained to my participants that this was an exploratory investigation and that I wanted to learn about their educational backgrounds. Or, as Charmaz (2006) said "the interviewer's questions ask the participant to describe and reflect upon his or her experience in ways that seldom occur in everyday life" (p. 25). I have never traveled to India and I revealed to the participants that I was naïve about their culture and that I had much to learn from them. I also asked if they had any questions before beginning the interview so that if they had any concerns I could address them. None of the students expressed any concerns and appeared excited to get the interview started.

Many of the students made faces and giggled when they saw the red light on the video camera light up to indicate it was recording. I began each interview with what Spradley (1979) defined as a "task-related grand tour question" (p. 87); that is, I provided each participant with a photocopied map of India and asked them to indicate on the map where he or she was from and to describe the location of their home. The task of drawing on the map immediately engaged the participants in lengthy, animated descriptions of the locations and the culture of their home states, thereby redirecting a focus on the video camera and assuaging associated feelings of anxiety or apprehension. Several of the students took the time to explain to me that the map I had provided was an old map. They drew outlines of states, wrote in names of towns related to their homes, and described the area so that I would have a more correct map as well as a better understanding about where they were from. As examples, I have provided a few brief excerpts from randomly selected participants:

Bombay is like uh one of the metropolitan cities in India, we have four metropolitan cities right now. One is Bombay, the other is Delhi and Chennai, and Bangalore so we have all these metropolitan cities which are quite like, maybe very different from the villages. They are more like Los Angeles California. Yeah, pretty crowded, you'll see the life in Bombay is like, it's just moving, you cannot see any people sitting idle. So it's full of rush, full of competition. So survival of the fittest is the motto (Rahul).

Anand is a pretty known place in India because this has one of the biggest NGOs that has used all the villages of this state and they have like the biggest dairy products industry stationed here [indicates on map] and which is like an international NGO now and it exports it's dairy products and everything so it's a real known place for it's industry significance, or so-called NGO significance (Rajeev).

I'm from Pune, it's about 110 kilometers from Mumbai.... It's a big city, more like I would say Phoenix, but not as big as Phoenix though, and of course Indian cities are a little different from here. The roads are different, smaller roads, less number of cars, more bikes, you know, motor bikes and stuff; it is actually known as the educational capital of Maharashtra, my state (Geomy).

Some of the questions I asked the students were similar, if not identical, but I employed a more spontaneous, conversational interrogation style and thus did not follow a structured set of predetermined questions.

Research interviews vary on a series of dimensions. They differ in degree

of *structure,* from well-organized interviews that follow a sequence of

standard question formulations, to open interviews where specific themes

are in focus but without a predetermined sequence and formulation of

questions (emphasis in original, Kvale, 1996, p. 127).

The 17 participants that crossed into Spradley's participation stage seemed to

appreciate the conversational style of the interview; they were enthusiastic and fervently

embraced the opportunity to share as many of their experiences, on a broad range of

topics, as they possibly could. For example, one student was telling me about her home:

My place is different because it has the borders of different countries. You

have some Nepalees, many Nepalees there, like you have Mexicans in US?

That's the way we have Nepalees in, in the state. I mean all the major

work is done by the Nepalees people. You understand? I mean all the

watchmens all the, some of the labor class, They're from Nepal and Tibet,

these are like, India is you know a very friendly country to everybody so it

takes in everybody, so we have a very big, you have heard of the Dali

Lama? So we have this very big, you know, sort of a monastery here so,

it's a mini Tibet. They speak their own language, they have their own

calendar ... so it's a mixed culture around here, we have more of a Tibetan

influence (Mrunalini).

Another student described how the software industry has changed the culture:

When I was in college, 100 rupees for me was really valuable. 100 rupees would get me like pretty much a half a tank of gas. And I, I used to think twice before I would ask my parents for 100 rupees it was really a huge amount of money to ask. Like, my dad, I told you, he used to earn like 10,000 rupees, so 100 was like it was huge. But now, this year when I went to India it was like 100 rupees even before I realized was out of my pocket.... So now India is more of becoming of the spending kind of crowd, like, they don't have money, but still they will spend. All credit cards. When I was there I hadn't seen like people spending, there were no malls as such, very few malls, and the malls were mostly like big shops, one single big shop. But now India is starting all the malls and its, its changing, its more like becoming US the structure, the western civilization is moving to India.... The industrialists view it as a good thing but the normal crowd views it as a bad thing. Because the industrialists are that same end of it. They want money. That's all they are going to want, but for the normal crowd, they are going and spending and at the end of their day they have spent more than they have earned (Gurunath).

To use Spradley's (1979) description, I presented the participants with "a frame and canvas on which to paint a word-picture of their experience" (p. 85). The participants that were fully engaged met Kvale's (1996) criteria for "good" interview subjects because they provided "long and lively descriptions of their life situation," and they told "capturing stories well suited for reporting" (p. 146). One of my participants was telling

me about the competition and pressure to enter kindergarten. He conveyed a story about

his four-year-old niece:

> They are putting more pressure on the students like give **more** homeworks,
>
> **more** practice for, for them it's like we'll give more practice to the
>
> students. The children are very small, how could they, I have seen my
>
> sister's kids going for tuitions. She is just four years old my niece and uh
>
> she wakes up early in the morning, she wakes up at 8:00 has her milk and
>
> all her breakfast then she goes for tuition at 10:00, ten, ten thirty, she
>
> comes back after uhm like at 12:00, one and half hours, then she gets, like
>
> she has a lunch, gets ready for the school, at 1:00 she leaves for her school,
>
> she comes back at 6:00, five, six o'clock, at 6:00 she's like at home
>
> (Rahul).

To end the interview sessions I asked the students if they had anything else they

would like to share, and after I turned off the recording devices I asked if they had any

questions or concerns which gave them an "additional opportunity to deal with issues he

or she [had] been thinking or worrying about during the interview" (Kvale, 1996, p. 128).

A couple of students had a few off-the-record comments but most did not have anything

further to add. Before parting to go our separate ways, I had one final question – I asked

the participants if they could be contacted again in the future to provide supplementary

information for clarification if necessary. All 18 participants eagerly agreed and stated

that they enjoyed having the opportunity to share their experiences.

Data Analysis

Transcription

My research was designed to obtain oral histories, thus the interview strategies I employed did not isolate participant responses into decontextualized fragments; that is, removing the responses "from the psychological and social contexts of the respondent as well as from the full discourse of the interview" (Mishler, 1986). As a result, my research produced approximately 32 hours of recorded interview data. The personal narratives of my participants included information regarding numerous general topics, beginning with the description of their homes and families, reflecting back to describe many facets of their childhood educational experiences and ending with their future plans upon completion of their graduate degrees.

With such a large amount of data from 18 participants, I determined that without a written text, analysis and interpretation of the participants' narratives would be problematic and that the recorded interviews would need to be transcribed. Van Maanen (1988) said, "only in textualized form do data yield to analysis" (p. 95). Mishler (1986) concurred: "systematic transcription procedures are necessary for valid analysis and interpretation of interview data" (p. 50). As I transcribed the interviews I again asked myself questions about the purpose of my research and it became clear that narrative analysis would not be appropriate. I wanted to provide an interpretative framework for readers and I did not believe that accurately representing 18 stories would generate the type of narrative I was looking for. My goal was to provide a framework that would tie together my participants' stories into a narrative that would lend insight into the

educational backgrounds of students from India who pursued engineering. Therefore, I
determined that an analysis of narrative would be a more appropriate method to pursue.
However, the wealth of data generated from the interviews presented challenges and I
decided that employing a logistical technique that would facilitate sifting through the data
was necessary for me to be able to conduct an analysis of my participants' narratives. I
found that utilizing comparative methods of constructing categories to discover, explore,
and analyze commonalities and/or disconfirming information across the students' oral
histories, a methodology employed by grounded theory techniques (Charmaz, 2006;
Polkinghorne, 1995), to be an effective method for conducting a useful analysis of my
data.

Utilizing a grounded theory methodology for analysis meant that at the time of
transcription, I had not determined a level of detail that would be required for adequate
interpretation. However, I was cognizant of a distinction between spoken discourse and
written discourse. Spoken discourse conveys meaning through the use of verbal and non-
verbal communication; for example, intonation, gestures, facial expressions and body
language (Kvale, 1996; Ricoeur, 1973). By video recording the interviews I was able to
capture this level of communication and I wanted to preserve as much meaning as
possible; therefore, a high level of detail in the transcription would be necessary. Mishler
(1986) argued that:

> Some minimum level of detail is required for any study, but how fine this
>
> detail must be depends on the aims of the particular study and remains a
>
> matter of judgment. It seems clear, however, that the value of succeeding

stages of a study—coding, analysis, and interpretation—depends on the

adequacy of the description of the phenomenon of interest, and in

interview research this means a carefully prepared transcript (p. 50).

Thus, every word exchanged between my participants and me, including "uhms" and

"ers," was transcribed. However, I would be the person who determined what information

was pulled from the transcripts and incorporated into the final text, the written discourse

(Mishler, 1986; Van Maanen, 1988).

Coding

I printed and read through all 18 transcripts numerous times making marginal

notes that identified line by line what action was taking place; a process identified by

Strauss and Corbin (1990) as "conceptualizing of data" (p. 29). Identifying discrete events

throughout each transcript and labeling them according to the action taking place, rather

than forcing data into preconceived categories, facilitated in resisting the temptation to

adopt existing theories too quickly (Charmaz, 2006). Labeling line by line action items

ultimately did not produce readily identifiable broad categories based solely on the events

portrayed in the transcripts. However, the process provided an opportunity for me to

critically examine all participant responses and be able to recognize emerging patterns

across their narratives. Separating data into specific categories across participants to

construct a theory was not my primary intention and therefore broader categories were not

explicitly identified in the margin notes during this phase of my coding. Instead, I

preferred to mentally note possible labels to be used during future categorization. For

Seidman (1998):

> The repetition of an aspect of experience that was already mentioned in
>
> other passages takes on weight and calls attention to itself ... [he] notices
>
> excerpts from a participant's experience that connect to each other as well
>
> as to passages from other participants (p. 109).

Conceptualizing the data yielded six initial themes. I chose to utilize these as

concepts and labeled them: Personal Identity, Competition, US, Education, Culture, and

Future. I then began using the electronic (Microsoft Word®) version of the interview

transcripts to expedite cutting and pasting of text. I examined all 18 transcripts for

common characteristics that would identify a sentence, phrase, or paragraph as belonging

to one of the six labeled concepts. Using the software program Microsoft OneNote®, I

created a folder for each participant; each student folder contained six separate pages, one

for each labeled concept. Text that was identified as a good fit for a particular concept

was cut from the transcript and pasted into the appropriate page of the participant folder.

Occasionally, a sentence, phrase or paragraph was identified as a good fit for more than

one concept. Rather than force the event to fit into only one of the six concepts, I pasted

text into all appropriate pages for future analysis and refinement.

> Paradigmatic thought attends to features or attributes that essentially
>
> define particular items as instances of a category. This kind of thinking
>
> focuses on what makes the item a member of a category. It does not focus

on what makes it different from other members of the category

(Polkinghorne, 1995, pp. 9-10).

Directing attention to defining what is essential about an event is a process Charmaz

(2006) called "clustering":

Clustering lets you make what lurks in the background jump into the

foreground. Use clustering to make things explicit and order your topic....

Hence you assess relative importance of the points within your cluster and

relationships between them (p. 87).

Polkinghorne (1995), crediting Anselm Strauss, described the process of

examining data for common characteristics, separating data into categories of similarity,

and inspecting the attributes that define membership in a particular category as a "general

practice of qualitative analysis" (p. 10). Clandinin and Connelly (2000) agreed, "an

inquirer composing a research text looks for the patterns, narrative threads, tensions, and

themes either within or across an individual's experience and in the social setting"

(p. 132). I inspected events in a specific concept relative to what all participants described

in that particular concept as a method for identifying patterns or themes. For example, the

Competition pages were printed for each of the 18 participants and examined for their

common attributes. I narrowed the focus so that the analytic framework included only

those events that were shared among the participants, keeping in mind that "interview

respondents may wish to appear affable, intelligent, or politically correct and thus shape

their responses accordingly" (Charmaz, 2006, p. 36). Episodes that were common among

my research participants and substantiated by outside sources were analyzed for their plot

potential, elevated from concepts to categories, and descriptively labeled The Cream; The Safety Net; Tuitions; The Process; IIT, and US. A research study "has relevance when you offer an incisive analytic framework that interprets what is happening and makes relationships between implicit processes and structures visible" (Charmaz, 2006, p. 54). "The big ideas are ones that emerge after involvement, rereading, and careful consideration of data.... Even so, considerable subjective judgment is involved in the selection and interpretation" (Vaughn et al., 1996, p. 105).

After careful examination of the coded data, I selected three participants to serve as exemplars: Karthik, Rajesh and Sagar; their stories were representative of the common attributes among all 18 participants.

For grounded theorists, coding is central to data analysis because it provides a crucial stepping stone between collecting data and constructing theory. Coding begins with a broad overview of the data and researchers return to the data multiple times, each time with more focus. "Like a camera with many lenses, first you view a broad sweep of the landscape. Subsequently, you change your lens several times to bring scenes closer and closer into view" (Charmaz, 2006, p. 14). At each step in the data analysis process, researchers must continually, ask "What is this data a study of?" (Glaser, 1978, p. 57). There are a minimum of two phases for grounded theory coding. Initial coding is the first phase; researchers investigate the data word by word, line by line, segment by segment, or incident by incident, noting what action is taking place at each level. The second phase, focused coding, extracts what appear to be the most useful initial codes and compares them with more data.

Throughout the process, we compare data with data and then data with

codes. We may follow special procedures to elaborate our codes or move

to extant theoretical codes but only if indicated by our emerging analysis

(Charmaz, 2006, p. 42).

Initial and focused coding break the data into discrete elements that need to be

brought back together, possibly in new ways. Axial coding provides the means to bring

the data back to a whole. Researchers examine the data and coding so that central ideas

emerge that become categories and subcategories. Subcategories are determined by the

specific features that relate it to the category as well as the strategies employed that deal

with the perceived situation and the results of employing those strategies (Strauss &

Corbin, 1990). Axial coding is not an essential process to undertake; it depends on the

researcher.

Whether and to what extent it [axial coding] offers a more effective

technique than careful comparisons remains debatable. At best, axial

coding helps to clarify and to extend the analytic power of your emerging

ideas. At worst, it casts a technological overlay on the data—and perhaps

on your final analysis. Although intended to obtain a more complete grasp

of the studied phenomena, axial coding can make grounded theory

cumbersome (Charmaz, 2006, p. 63).

Memo writing and diagramming are also essential elements for employing a

grounded theory method of data analysis. Researchers write memos to critically examine

perceptions about the codes that were previously established. Memos are written by the

researchers, for the researchers; they are not written for an audience, their purpose is to help researchers collect their thoughts, explore new ideas, identify corroborating or disconfirming evidence, and move toward a theoretical framework. Diagrams provide a visual means for researchers to establish relationships among categories. The step in the data analysis process of memo writing and/or diagramming should never be skipped; it is a crucial element in building theory (Charmaz, 2006; Strauss & Corbin, 1990).

I posit that the questions researchers should ask themselves continuously when employing narrative research are "What do you want your readers to get out of it?" and "Why are we writing?" (Clandinin & Connelly, 2000, p. 121). Whether a researcher is conducting narrative analysis or analysis of narrative, considering what readers should get out of the story as well as why the story is being written are important features during data analysis. Central to narrative data analysis is interpretation; "in narrative thinking … there is an interpretive pathway between action and meaning mapped out in terms of narrative histories" (Clandinin & Connelly, 2000, p. 31). Similar to grounded theory methods, narrative research usually involves searching and re-searching the data. Researchers bring their own perspectives and personal histories into the analysis, and return to the data multiple times as the plot unfolds and researchers address questions regarding what they want readers to get out of the story and why they are writing the story. Narrative data yields extensive research potential; therefore, grounded theory methods may provide a means for sorting through the vast amount of data. In fact, Clandinin and Connelly (2000) stated that they:

explored grounded theory methods, such as those that Glaser and Strauss

wrote about. We became entranced by their ideas of the theoretical memos

and themes and categories as a way to read interview transcripts (p. 127).

Grounded theory coding techniques are similar to paradigmatic analysis for

narrative as a means of identifying common elements that relate to establishing the plot

because "paradigmatic analysis of narrative seeks to locate common themes or conceptual

manifestations among the stories collected as data" (Polkinghorne, 1995,

p. 13). However, for narrative analysis, researchers inspect the data to determine which

elements relate to an extant theory, a deductive approach; whereas for analysis of

narrative, researchers seek to identify, inductively, the relationships that will construct the

plot (Polkinghorne, 1995). During data analysis it is especially important that researchers

understand that plot is more than just the thematic thread, so I have reiterated

Polkinghorne's description:

> Plot is the narrative structure through which people understand and
>
> describe the relationship among the events and choices of their lives. Plots
>
> function to compose or configure events into a story by: (a) delimiting a
>
> temporal range which marks the beginning and end of the story, (b)
>
> providing criteria for the selection of events to be included in the story, (c)
>
> temporally ordering events into an unfolding movement culminating in a
>
> conclusion, and (d) clarifying or making explicit the meaning events have
>
> as contributors to the story as a unified whole (1995, p. 7).

The primary purpose of narrative data analysis is to advance the plot. Utilizing Polkinghorne's (1995) description of plot, data analysis also serves to identify the temporal setting and to organize discrete events into a whole so that a story can be presented based on a continuum that has a beginning, a middle and an end. The primary purpose of grounded theory data analysis is to code the data sufficiently so that categories can be identified that will ultimately lead to a constructed theory.

Sampling Procedures

To assist in developing my narrative framework, I utilized several heuristic devices including some of the sampling procedures advocated by Strauss and Corbin (1990). Open sampling techniques facilitated in identifying my first six concepts: Personal Identity; Competition; US; Education; Culture and Future. Discriminate sampling strategies helped in establishing my foundational categories, The Cream; The Safety Net; Tuitions; The Process; IIT, and US. And, while my purpose was not necessarily to develop a theory regarding the experiences of my participants, data saturation and theoretical sampling strategies guided the framework for the plot of my story. Or, as Charmaz (2006) stated "theoretical sampling directs you where to go" (p. 100).

Theoretical sampling, open sampling, rational and variational sampling, and discriminate sampling are procedures exclusive to grounded theory research because they are associated with specific coding techniques utilized during data analysis. Concepts from the data emerge by employing methods of initial coding and focused coding during

data analysis. Then, through memo writing the theoretical framework begins to surface. However, theoretical categories cannot be established until concepts have what Strauss and Corbin (1990) referred to as proven theoretical relevance which they defined as: "[indicating] that concepts are deemed to be significant because they are repeatedly present or notably absent when comparing incident after incident, and are of sufficient importance to be given the status of categories" (p. 176). Once categories have been identified, theoretical sampling can take place. Theoretical sampling:

> means seeking pertinent data to *develop* your emerging *theory*. The main
>
> purpose of theoretical sampling is to elaborate and refine the categories
>
> constituting your theory. You conduct theoretical sampling by sampling to
>
> develop the properties of your category(ies) until no new properties
>
> emerge (emphasis in original, Charmaz, 2006, p. 96).

The identified categories are examined so researchers can be assured the categories are sound; that there are no weaknesses or additional questions that arise. If the categories are deemed to be insufficient, researchers should collect more data directly focusing their attention on areas that will strengthen the categories.

> Thus, you *saturate* your categories with data and subsequently *sort* and/or
>
> diagram them to integrate your emerging theory…. Categories are
>
> 'saturated' when gathering fresh data no longer sparks new theoretical
>
> insights, nor reveals new properties of these core theoretical categories
>
> (emphasis in original, Charmaz, 2006, pp. 96, 113).

Open sampling, relational and variational sampling, and discriminate sampling are

procedures that Strauss and Corbin (1990) advocated. It is useful to provide some terms

that Strauss and Corbin defined, and incorporated, regarding sampling:

- *Concepts*: Conceptual labels placed on discrete happenings, events, and other instances of phenomena.

- *Category*: A classification of concepts. This classification is discovered when concepts are compared one against another and appear to pertain to a similar phenomenon. Thus the concepts are grouped together under a higher order, more abstract concept called a category.

- *Open Coding*: The process of breaking down, examining, comparing, conceptualizing, and categorizing data.

- *Properties*: Attributes or characteristics pertaining to a category.

- *Dimensions*: Location of properties along a continuum (p. 61).

Open sampling is associated with open coding during which time emerging

concepts are named and categorized according to their properties. Open coding is the

terminology Strauss and Corbin adopted; whereas Charmaz utilized initial coding to

represent a similar process. Strauss and Corbin (1990) stated "the aim of sampling here

[during open coding] is to uncover as many potentially relevant categories as possible,

along with their properties and dimensions" (p. 181). Relational and variational sampling

occurs during the axial coding process. "Its aim is to maximize the finding of differences

at the dimensional level" (Strauss & Corbin, 1990, p. 176). And, discriminate sampling is

affiliated with Strauss and Corbin's term selective coding, a process similar to the

focused coding that Charmaz advocated. During selective coding core categories are

identified and related to other categories, relationships are validated and thin categories

are further refined. The goal of discriminate sampling "is to maximize opportunities for verifying the story line and relationships between categories and filling in poorly developed categories" (Strauss & Corbin, 1990, p. 176).

From Grounded Theory to Plot

The primary focus of my research involved an anecdotal case: East Indian engineering graduate students in mechanical or aerospace engineering at ASU. Their personal stories were retrospective in that they reflected on their school experiences beginning in kindergarten, and temporal, ending with their plans upon completion of their graduate degrees. Thus analysis of narrative was the method utilized to create the plot.

Whether researchers decide to employ grounded theory methods or narrative methods, it is useful to have a set of criteria or some guidelines regarding the requisite information for theoretical construction. Grounded theory requires: "a close fit with the data, usefulness, conceptual density, durability over time, modifiability, and explanatory power" (Charmaz, 2006, p. 6). Narrative research requires that:

Studies have temporal dimensions and address temporal matters; they

focus on the personal and the social in a balance appropriate to the inquiry;

and they occur in specific places or sequences of places (Clandinin &

Connelly, 2000, p. 50).

Grounded theorists are urged to postpone literature reviews until after the theory has been constructed because theories need to emerge directly from the data and conducting literature reviews prematurely may influence how researchers perceive and

interpret the data (Charmaz, 2006; Strauss & Corbin, 1990). Similarly, narrative

researchers "tend to begin with experience as expressed in lived and told stories"

(Clandinin & Connelly, 2000, p. 40). Grounded theorists are constantly moving through

their data as they construct their theories. A possible theory may emerge but then

researchers find that they need contributing information and they return to the data. The

driving question that grounded theorists should ask at every stage of theory construction,

as well as during data analysis, is again: "What is this data a study of?" Building a

grounded theory is a fluid activity; researchers must constantly look for connections and

ask questions.

> Theories present arguments about the world and relationships within it ...
>
> theories flash illuminating insights and make sense of murky musings and
>
> knotty problems.... A theory can alter your viewpoint and change your
>
> consciousness. Through it, you can see the world from a different vantage
>
> point and create new meanings of it (Charmaz, 2006, p. 128).

Similarly, the theoretical construct for narrative is the plot; "the plot provides the

systemic unity to the story; it is the glue that connects the parts together" (Polkinghorne,

1995, p. 18). Narrative analysis "attempts to fulfill the ideal of a formal, mathematical

system of description and explanation. It employs categorization or conceptualization and

operations by which categories are established" (Bruner, 1986, p. 12). Narrative analysis

reaches toward an abstract theoretical base focusing on what is common among actions

and is not concerned with the particular or anecdotal case. In other words, narrative

analysis moves "from case to generalization" (Polkinghorne, 1995, p. 11). Analysis of

narrative "leads instead to good stories, gripping drama, believable (though not necessarily 'true') historical accounts" (Bruner, 1986, p. 12). Analysis of narrative focuses on the special features of the separate actions and is concerned with the particular or anecdotal case. In other words, analysis of narrative moves "from case to case" (Polkinghorne, 1995, p. 11).

Types of Voice and Position of the Investigator

"For Bakhtin, an utterance, or individual speech act, presupposes a response from an 'other' and meaning is made between partners in dialogue" (Coulter, 1999, p. 6). My search to find meaning in the educational experiences of my participants that would complement quantitative studies related to the number of engineering graduates in India, led to a conversant style of interviewing; thus my participants and I became partners in a dialogue. The story presented is not necessarily what Bakhtin (1985) termed epic because I incorporated the voices of several participants as well as those from other sources. Epic is written in monologue, there is one person's voice. However, difficult questions emerge regarding voice. During my theoretical sampling I adopted Charmaz's (2006) strategy of seeking "statements, events, or cases that will illuminate your categories" (p. 103) and I reduced the number of personal histories that would serve as foundational from 18 to 3. Therefore, I must ask myself if the story is epic because the prohibitive logistics of conducting an extremely large study excluded many other stories, many other voices. I address that question by saying that it is not purely epic because as author, my voice, my

point of view is not dominant and I am not making claims that the story presented is the only story, the only version, the only "truth".

As much as possible, I faithfully portrayed my participants' stories in that I made every effort to maintain the integrity of the context of the original stories as they were conveyed to me. Yet, I am aware that my position is not invisible, by analyzing the data, I made decisions to pull quoted material from the transcripts that would facilitate in the development of the plot. However, ultimately I am the person constructing the story, and my influence on the narrative removes it from being purely novel. I argue that if placed on a continuum, the story I present is considered to be more novel than epic because it incorporates "a plurality of independent and unmerged voices and consciousnesses, a genuine polyphony of fully valid voices" (Bakhtin, 1984, p. 6). Additionally, the communication between my participants (as speakers) and me (as listener) provided an:

> orientation toward the listener ... an orientation toward a specific
> conceptual horizon, toward the specific world of the listener; it introduces
> totally new elements into his discourse; it is in this way, after all, that
> various different points of view, conceptual horizons, systems for
> providing expressive accents, various social "languages" come to interact
> with one another (Bakhtin, 1984, p. 282).

Grounded theorists and narrative researchers, I would argue all researchers, need to be cognizant that when they enter the study they bring with them their own personal histories; therefore, they should "be alert to possible tensions between those narrative histories and the narrative research they undertake" (Clandinin & Connelly, 2000, p. 46).

"Grounded theorists can ironically import preconceived ideas into their work when they remain unaware of their starting assumptions" (Charmaz, 2006, p. 131). Qualitative research, especially narrative inquiries, have been criticized that:

> Voices are heard, stolen, and published as the researcher's own or that the researcher's voice drowns out the participants' voices, so that when participants do appear to speak it is, after all, nothing more than the researcher's voice code (Clandinin & Connelly, 2000, p. 75).

It is inherent in grounded theory that researchers' personal narratives influence the study because the process of building theory involves interpretation of the data, and decisions are made regarding what data emerge as concepts, then are elevated to categories, and ultimately lead to the constructed theory. When ethnographic methods are employed for research, field texts often become the primary data source. This is another area that may be heavily influenced by researchers' personal histories because decisions regarding what aspects of the experience to attend to, or ignore, in the field notes, even when collaboratively created, are essentially subjective (Clandinin & Connelly, 2000; Strauss & Corbin, 1990).

Some grounded theorists, and some narrative researchers who employ narrative analysis, believe that data should not be analyzed, that it is the researchers' task to present data so that only the participants' voices are heard (Strauss & Corbin, 1990, p. 21). The philosophical underpinning is that researchers' personal histories, biases and even their presence will not affect the data and that an accurate account of the studied experience can be conveyed. Clandinin and Connelly (2000) disagreed: "In narrative

inquiry, it is impossible (or if not impossible, then deliberately self-deceptive) as researcher to stay silent or to present a kind of perfect, idealized, inquiring, moralizing self" (p. 62). Charmaz (2006) claimed that grounded theorists do not need to try and stay silent: "even grounded theorists do not have to write as disembodied technicians. We can bring evocative writing into our narratives" (p. 174).

Regardless of what researchers' philosophical beliefs are regarding voice, the primary consideration when writing text should always be to write for the audience. Researchers should continually ask: "What do you want your readers to get out of it?"

Plausibility and Truth Values

Relying on personal histories obtained through extensive interviews raises questions. My participants, most of whom were in their twenties at the time of the interviews, reflected back to their childhood educational experiences, but can memory be trusted? Does it matter if my participants were faithfully portraying their experiences? Does it matter if my participants actually lied about their experiences? To address these concerns, I again asked myself about the purpose of my research and what I wanted my audience to get out of the narrative I constructed.

The purpose of my research was to provide a narrative that allows readers to think beyond just the numbers of engineering graduates in India, to think more profoundly about the educational experiences of the people behind the numbers and to engage interested readers. Dr. Barone argued in my narrative research course that for this type of purpose it does not matter if the stories, as conveyed to me, are true because there is not

one correct story to be told. "Truth, for Bakhtin, emerges from a genuine communication between people; it is not imposed by one partner on the other" (Coulter, 1999, p. 7). Therefore, truth was created during the dialogue generated between my participants and me, and establishing credibility rather than searching for truth was important. I wanted to determine whether the likelihood that the events portrayed by my participants could have occurred, in other words, were their narratives plausible. Thus corroborating stories from sources other than the interviewed students were investigated through a literature search and are included in my narrative. Postponing the literature review until after my data had been collected and analyzed allowed me to focus my research toward the categories that would ultimately provide the framework for the plot of my presented narrative. My literature review, combined with my data analysis and member-checking the concepts revealed by my participants' stories, served as a method of triangulation. Triangulating the data provided me with confidence that the oral histories of my participants were credible, that the stories told were plausible, that the experiences could have happened.

Triangulation methods are often utilized in quantitative studies as a means of increasing validity and reliability of collected data. Patti Lather (2003) argued that more rigorous approaches in qualitative research are necessary and she provided guidelines for inclusion into research designs. The first guideline regarding triangulation stated:

> *Triangulation*, expanded beyond the psychometric definition of multiple
>
> measures to include multiple *data sources, methods,* and *theoretical*
>
> *schemes,* is critical in establishing data trustworthiness. It is essential that

the research design seek counterpatterns as well as convergences if data

are to be credible (emphasis in original, p. 191).

Utilizing Lather's criteria for triangulation was not necessarily appropriate for my

research study because her primary focus was on establishing validity; whereas my

primary focus was on establishing credibility. For example, if I was able to travel to India

to conduct on-site ethnographic observations of classrooms in India, I would have more

closely met Lather's criteria for obtaining an additional source of data to be used in

triangulation. Yet, Polkinghorne (1995) indicated that employing triangulation strategies

in qualitative research is also important to facilitate establishing credibility "because the

story is offered as a scholarly explanation and realistic depiction of a human episode, the

researcher needs to include evidence and argument in support of the plausibility of the

offered story" (pp. 19-20).

A researcher must have confidence in their data regardless of what type of

research is being conducted. Narrative researchers, who choose to pursue analysis of

narrative as their research method, examine data to identify common characteristics that

classify discrete episodes as belonging to a specified category; the individual features

define whether or not a particular episode is a member of the category. Similarly,

grounded theorists examine their data when they are seeking to identify categories (as

defined by Strauss and Corbin previously) during the coding process. While quantitative

methods require a pre-selection of category attributes, qualitative methods focus on the

construction of categories based on the particular characteristics that emerge from the

data. For both narrative researchers and grounded theorists the process of identifying

membership in a category transpires when analyzing data. Researchers move throughout the data looking for patterns, themes, narrative threads, actions, and responses that appear when one concept, episode or story is compared against another concept, episode or story; a process sometimes known as member-checking. It is important that the focus remain on the characteristics that make the item a member of a category, not what makes it different (Charmaz, 2006; Clandinin & Connelly, 2000; Polkinghorne, 1995; Strauss & Corbin, 1990). As categories emerge they may be refined or the particular requirements for membership in a category may be altered. Therefore, it is important that researchers' test and re-test membership.

> The analysis builds the categorical definitions by continually testing their
>
> power to the data. The categories are revised and retested until they
>
> provide the "best fit" of a categorical scheme for the data set
>
> (Polkinghorne, 1995, p. 10).

When narrative research includes several case studies regarding the investigated phenomena, confidence is enhanced by identifying "a set of profiles or vignettes that, alongside each other, provide greater insight and understanding of the topic than any single vignette" (Polkinghorne, 1995, p. 21). Comparing items among each other is not the only way to build data confidence. Positioning data "relative to other streams of thought, research programs, and ideologies" (Clandinin & Connelly, 2000, p. 136) becomes particularly useful when transitioning from areas such as from ethnographic field notes to research texts. Additionally, material from a variety of outside sources can be included verbatim as a means of facilitating more precise comparisons and moving

beyond the anecdotal. Similarly, a literature review provides opportunity for comparison with other researchers' work. For grounded theorists in particular, this type of comparison provides evidence that can highlight the constructed theory in terms of the contribution it makes to the field (Charmaz, 2006; Clandinin & Connelly, 2000). Researchers that continually move in and out of their data making comparisons and member checking might discover that "what outsiders assume about the [studied] world ... may be limited, imprecise, mistaken, or egregiously wrong" (Charmaz, 2006, p. 14).

Narrative research results in story; the story must be plausible for it to be accepted by, and engage readers. As Mishler (1986) stated:

> The critical issue is not the determination of one singular and absolute
>
> "truth" but the assessment of the relative plausibility of an interpretation
>
> when compared with other specific and potentially plausible alternative
>
> interpretations (p. 112).

One method of assessing plausibility is suggested by Polkinghorne (1995): "the use of triangulation methods in which several independent reports of an event are sought can help in producing confidence that the event occurred" (p. 20). In my narrative research class, Dr. Barone stated that researchers should never make claims of truth regarding story; even when narrative analysis is used. One explanation for not posing claims of truth is presented by Charmaz (2006):

> Researchers and research participants make assumptions about what is
>
> real, possess stocks of knowledge, occupy social statuses, and pursue
>
> purposes that influence their respective views and actions in the presence

of each other ... how people explain their actions to each other may not

resemble their statements to an interviewer. Moreover, participants' most

important explanations may consist of tacit understandings. If so, then

participants seldom articulate them out loud among themselves, let alone

to non-members (pp. 14, 25).

Grounded theorists also need to provide evidence supporting their arguments. However,

the strategies employed when using a grounded theory approach inherently build

confidence because system checks are built into data collection as well as the analysis of

the data. Researchers continually move through the data as the theoretical foundation is

constructed and they search for alternate explanations and disconfirming evidence.

Searching and re-searching the data provides multiple opportunities for critical

examination of source information and prevents building a theoretical framework based

on insufficient or misleading data (Charmaz, 2006).

CHAPTER THREE

Narrative Construct of the Educational Experiences of Engineering Students from India Who Are Pursuing Graduate Degrees at Arizona State University

I reviewed the videotaped interviews of Karthik, Rajesh and Sagar several times. While it is difficult to convey emotions that are encoded in body language and facial expressions, such as their smiles, excitement, and hand gestures, etc., I tried to capture and convey such emotions to the reader through my use of typeface. Text that is italicized represents the voices of Karthik, Rajesh and Sagar. When they emphasized a word or phrase, I indicated that by bold italic print. If they were very animated and excited I capitalized the italics. Often they would use their hands to gesture quotes and I represented that by placing the term or phrase in quotation marks.

Karthik[1]

I have known Karthik for two years; however, at the time of the interview, I had only met with him half a dozen times. Karthik would come to my office so that I could clear him for course registration, process his Program of Study, or process other documents related to the pursuit of his Master of Science degree in mechanical engineering. Whenever we met he was always respectful and soft-spoken, we would conduct our business and he would leave my office; we rarely engaged in casual conversation. I don't know if he was somewhat shy, if he was being respectful of me professionally, or if he was simply too busy to chat. Whatever the reason, we had not established a personal relationship so I was somewhat surprised when he volunteered to

---

[1] In accordance with IRB policy, the names of my key participants are pseudonyms.[1]

be a participant in my research. I was expecting this interview to be short, and I did not expect to gain much insight because I thought that our interview conversation would be much the same as our business meetings. I could not have been more mistaken. Karthik arrived at the interview and I could feel the excitement emanating from him. I was not the first person to speak, I turned on the video recorder and Karthik began *Great, so you want me to talk about why I came?* "Well, we are going to go way back, we're going to kind of take a journey through your childhood." *Oh Great! I love this!* Karthik laughed and continued, *this is getting interesting.* Information flowed from Karthik like a great river trying to reach the open sea; he was animated, expressive, articulate, and my role during the interview became that of an active listener.

Karthik was born in Southern India but his family moved to England when he was four years old because his father, who is a plastic surgeon, received a job offer there. Karthik's primary education, from kindergarten through the sixth grade, took place in England:

> *I went to school in a couple of places in England. Wakefield, Sheffield, Birmingham and the longest for two years in Stoke on Trent. I always was in a public school. More often than not I was the only Indian, and in some cases the only colored student in the whole school. The majority of the students were from working class families. Not too many children of doctors, engineers, etc.*

His family returned to India when Karthik was in seventh grade, however this time they lived in Northern India. He said that moving back and forth was confusing,

I mean I used to have some idea of what being an Indian was when I was

in England and that was broken into pieces when I came to India because

I had, I mean the only exposure I had to India as a kid was my summer

visits to my grandparents' house in Chennai located in South India *and*

that was it. I used to have this wonderful concept of what a country it was

and sure it was dirty, sure there were cows on the road, but hey, you

know, it's a great place and I am Indian, quote unquote, whatever that

meant. Then I came to Jaipur located in North India, *it confused the hell*

out of me. I had culture shock when I came back.

Upon completing tenth grade Karthik convinced his family to return to Chennai for his pre-university studies during the eleventh and twelfth grades and he stayed in Chennai to complete his undergraduate degree.

Primarily Chennai is one of the best places in India to study.... Schools in

Chennai are amazing and the Indian system itself pushes you a little more

than it should and Chennai pushes you a little more than every other

place. And so I wanted to come to Chennai and when I came there I

*thought, you know, I must **now** be amongst people that I get along with*

and understand, and sadly that is not the case.

Karthik was 24 years old at the time of the interview. A few months after our interview he completed his Master of Science degree and he stayed in the US to pursue a PhD degree; although he did not stay at ASU for his doctoral studies.

Life in England

When Karthik arrived in England at four years of age he did not speak a word of
English and he faced some challenges:

> *I went into a shell for three months. I didn't say a word and the teacher*
>
> *was quite worried whether I was mentally challenged or something*
>
> *because as a kid I would not really socialize much. England doesn't have*
>
> *as many Indians as Tempe, so I was **easily** noticed, and being a kid in a*
>
> *foreign country, you're the only brown one in a hundred mile radius, I*
>
> *mean you stand out, so you want to keep quiet.*

The educational structure during Karthik's primary schooling years in England
was very different from that experienced by his classmates in India. However, he believed
that having the opportunity to study in England gave him an advantage when he returned
to complete his secondary education in India because:

> *They insisted on some things which Indian schools don't, like reading. I*
>
> *think that the ability to read and the ability to find information for yourself*
>
> *and to just go out and study, that really helped **a lot**.... But, things were*
>
> *very haphazard, you didn't have like well-defined subjects; if anything*
>
> *there was just English and maths and something called a project. Every*
>
> *quarter or semester you would concentrate on a specific issue ... and you*
>
> *would concentrate on working towards expanding yourself on that.... And*
>
> *so it was a very haphazard way of learning, but you'd learn one thing to*

the depth, you wouldn't learn, you wouldn't have a breadth, but you'd

have a depth.

      Of course, when I came to India it was the reverse scenario; you'd

have a breadth, you don't really have much of a depth and they insist that

you know **everything**, *not too well, but know everything.... In school no*

one gets to choose their subjects. Even in high school, choices usually

limit 11th and 12th grade students to wide streams like science and

commerce which include subjects like physics, chemistry, maths and

economics, accountants, and business studies respectively. You almost are

always expected to excel in every subject since all the grades are added up

together with equal weights to formulate a rank list based on percentage

of maximum possible marks; it forces the student to perform well overall.

A student who excels say in maths and not so in other subjects is not

looked upon as the ideal student.... And that probably helped having, you

know, a depth from there [England] *and a breadth from here* [India] *and*

you combine it and you get a well-rounded education.

Attending school in England did not mean that Karthik escaped the more

structured educational experiences of India:

      My parents did insist that when I come home from school *I study*

my Indian textbooks which probably helped a lot because they're usually

more advanced. They were formal education; it was a history book, you

know, a math book, a science book, uh, a government book, so that you

*would understand all the facets. And I would have to come home and my parents would tutor me and I would, they'd give me homework. I'd have to do school homework, I'd have to do their homework. Education is highly valued, especially in our community. That's one thing that we **really** insist on. You **have** to get educated. And I think, pretty much I spent my entire time in England doing that, studying both systems.*

*So that's how my life in England was and I think it **really** helped improve my English for one thing, and build an attitude that, you know, I can find stuff out for myself. I have enough confidence in myself, which the Indian system doesn't really insist on. The American system does, they like to build on the confidence of the child first. The Indian system doesn't necessarily. We don't always look at confidence as a good thing; deference is a good thing, confidence need not necessarily be a good thing. Standing with your head held high **all** the time is being, is seen more as stubborn than confident.*

A Return to India

*Sure my parents were strict, I'm not kidding that. My parents were **remarkably** strict, and I don't know how I got through that but I did, and I thank them for that, you know, because when I came back to India I didn't have a problem at all adjusting to the system.*

Karthik's father had friends who were doctors in England originally from India. *They never insisted on their children learning Indian education.* Some of them tried to return to India but Karthik said:

> *Those people had an enormous problem adjusting with the education*
>
> *system in India. It is cruel, it is outright cruel, the education system. What*
>
> *it expects of children. I don't think anyone else expects it. Probably the*
>
> *Japanese system expects that much. I mean we have suicides in India*
>
> *where children commit suicide at tenth grade because at tenth grade there*
>
> *is a national level examination. And, uhm, usually if you don't score well*
>
> *in that, you don't get your subject choice in eleventh and twelfth, even in*
>
> *your own school. Your own school will deny you admission, you know, you*
>
> *flunked it, just get out, go, go to a dumber school. Yeah, and so students*
>
> *have committed suicide. You hear that year after year, and it's pathetic. I*
>
> *honestly feel that's dumb and not everyone is that strong; you know, you*
>
> *can't expect that kind of strength from a 15-year-old. But that's what*
>
> *India expects and the ones who get **through**, sure, you know, they're*
>
> *amazing, but it's kind of barbaric in a sense.*

I asked Karthik what happens at the end of that examination, why there is so much pressure. He responded:

> *In India we believe, for some strange reason, that science is better*
>
> *than anything else in the world. Uhm, usually in eleventh you have to*
>
> *choose your stream. Up 'til tenth you study history, civics, mathematics,*

science, geography, economics, biology, chemistry, physics, you know,

*and two to three languages. So you probably have **easily** I think 10 to 15*

subjects 'til your tenth standard.... And, you have to do well in all of them.

Usually you need above 85%, as an average, for your school to let you

have science as an option. Since everyone wants science, the cutoffs are

for science. If you don't get science you get what's called commerce which

usually involves economics, business studies, uhm, accountancy and, uh,

something else, I forget. There is a perception that those people who do

those subjects are slightly dumber. Well, because they didn't have a cutoff,

so defacto, you're dumb.

But there are people who want to do that. My brother wanted to do

commerce always. He was never interested in science. He's an investment

banker.... The Indian mentality as such is a step function, you know, if not

this, then this, if not that, then that, we plan. We do this wonderful

planning with the familial bond, you're gonna do this, you're gonna go to

this school, if you don't get into that school we'll put you into that school,

if you don't get into that school we could put you into that school and then

at the end of tenth standard we'll try to get you back into the good school

that we wanted you to go to in the beginning, and then at the end of twelfth

you study your streams. I took science.

I asked Karthik what happens if you want to become a novel writer, or an artist, a

painter or a sculptor. He giggled and said:

Think of it contextually, India is a developing nation. Those things don't

get you money. Or rather, those things don't give you stability. And the

Indian mentality has always been to strive for stability for the larger

population. We don't care about the genius, we don't care about the idiot,

the mediocre have to be stable for the society to progress.... We train our

children to be, you know, you're going to be a good husband, you're going

to be a good wife, your gonna have children and you're gonna look after

*society. You're gonna do the **little** bit. Everyone does the little bit,*

something good happens.

Regarding mathematics education Karthik said that *the Indian math ed insists that*

you have everything in your mind, should be memorized, on your fingertips, you should

*be **so** fluent.*

According to Karthik there are about 40-50 students in a class with one teacher. I

asked him if there was any type of cooperative learning: *Oh, No, No, No; you keep quiet,*

don't even talk. Don't even bother putting your two cents, you don't have any. Just sit,

take your notes, if you're not taking notes, get out.

Engineering in India

*I saw **all** my classmates, they were **hounding** for engineering. You*

ask them, "do you even know what engineering means?" We've never

done it in school, we've done physics and maths, we've not done

engineering. We've never made anything, none of us makes stuff. I know

students in England and in America in high school might end up making

stuff; you might actually have true exposure to engineering. None of us do,

why do you do it? There aren't reasons to Indian mentality, ... we just

think that we're supposed to do engineering for some weird reason; that

it's respectable, you're an intelligent person now, you have an

*engineering degree, it means you **know** something. Ultimately, it's the*

society propagating and that's what they want. Society propagates when

*you have intelligent people. **Eligible** people. Define eligibility and that's*

*what the whole, the **WHOLE** shenanigan is **all** about, defining eligibility.*

    Dads in India are primarily concerned that you be able to bring in

*the money every month ... their **only** concern in life is that you be*

economically well off.... Marriage comes back again and again in the

*Indian culture. It's **very** important. It's expected of everyone.*

I asked Karthik about the public education system in India:

Nowadays public education is pathetic. A respectable family wouldn't put

his son in a public educational institution. That would not happen. I think

*that's the **best** measure of anything in India, you know, would a*

respectable family do it? Would a respectable family offer their daughter

in marriage to this guy? That's the measure, you know. And again, it's all

why would you want to go to a good school, so you can get married to

someone ... additionally, *a boy who has uh, qualification, you know,*

Master of Science from the US is really prized high. That's like WOW,

he's a good catch.

The Extra Mile

Karthik reiterated that some of the best schools for pursuing the science stream are in Chennai and that he went to one of them. I asked him if he attended one of the prestigious Indian Institute of Technology (IIT) schools:

*No, no. It's one of the best schools in India, and uh, on an annual basis I think ten students go to IIT from our school. There's another funny thing there. Your **school** education is not gonna get you into IIT. The IIT standards are **way** ahead of the school level. And I went to one of the better schools, even then it's, it's way far ahead of that ... honestly what you **need** is extra coaching. And there's an industry set up for that. And every one of my friends went to that. I didn't, I was the only one in the entire school. We had three branches, I was the only one in all three branches not to go for the coaching class.*

Karthik would ask his classmates *"Why do you hurt yourself doing this coaching class?" 'cause our school got over at 4:30, they would go 5:30 to the coaching class, that would go until 9:00. Come home, eat, they give homework and it's not just simple homework, it's hard and it's **lots**. These people would stay awake easy 'til twelve; talking 15- 16-year-olds, staying up 'til twelve. As a graduate student I don't do that. And get up in the morning, be in the school by 7:30. Usually what happens is the guys who go for coaching classes, their grades in school drop. Yeah, but they don't care because IIT doesn't **need** good marks in school. They don't*

*care. IIT just wants you to pass school and do well in **their** exam. So then*

the 15- 16-year-old takes a bet; how good am I truly? Can I put so much

effort into IIT that I will guarantee myself an IIT seat and I can let go of

my school grades? For some people it pays off, for some people it doesn't.

They lose IIT, they get bad grades in school and so they don't get into a

good college. And so other colleges usually require you to have a good

grade so that you can get an engineering seat. So then what happens is,

another industry is set up for those people who had bad grades in school

but still want to do engineering.

Then what happened was uh, the government came in and said,

you know, this is turning out to be a little ugly and that uh people are

actually giving money to get seats. Obviously that's gonna happen, you

have a country of a billion and you have opportunity for a million and you

are going to create corruption. So the government set up a standardized

examination.

Why Mechanical Engineering?

*I **have** to do something that makes sense and it was my uncle from IIT,*

who's a mechanical engineer, he said you know maybe mechanical

engineering is a good choice for you.... I don't think I scored enough for

computer science. Computer science is at the top. I would have liked it

because it's the most mathematical of all the engineerings. I envied my

computer science friends 'cause they had some easy stuff. I mean you

don't have to sit in a lab and break metal and go to a carpentry, and oh

man, I'm pathetic, I mean look at me, I can't do those things.... Physically

workshop was a nightmare for me.

Why the United States?

I just didn't like the Indian education system. I am a guy who likes

studying. I love studying, I love my subjects. I'm a nerd, I admit that, but I

need the freedom to study what I want, the way I want to. Uhm, that is just

not there in India.

What's Next...

*I want to go back. I am **so** sure I want to go back. Primarily there's*

someone waiting for me there, so I have to get back to her.... I am

definitely going back, not just for her, but I seriously want to. I love

teaching and I've, you know, I used to teach in college; I was always the

guy who helped everyone else ... I loved doing that and I really think that

the Indian education system really needs a revamp in certain places;

primarily the attitude. You know, firstly there's a saying in India, uh

Matha, Pitha, Guru, Dev, which means Mother, Father, Teacher, God.

That's the order in which you place people.... So the teacher is pretty high

up; he's above God. I don't think it's nice for the student to say this, but I

think it's really bad for the teacher to believe it. I don't think a teacher

*should really believe he's **that** amazing; 'cause he was a student once*

himself ... so that's probably what Indian education really needs to

change; teachers shouldn't be so autocratic.

Rajesh

At 32 years of age Rajesh was the eldest of the students that I interviewed. I have known Rajesh for four years; however, he has been a graduate student at ASU for nine years. He completed his Master of Science degree in Civil Engineering in 2002 and he stayed at ASU to pursue a doctorate degree in Mechanical Engineering. Conversations with Rajesh were frequent and extended beyond the business that would bring him to my office; that is how I discovered that he was very interested in film making. We were comfortable around each other and engaging in discussions about a variety of topics seemed to flow naturally; yet when he arrived for the interview he seemed a little nervous. He sat his bottle of water on the desk and he did not say a word as he waited for the first question from me to begin the formal interview. It only took a few minutes for the awkwardness we both felt to subside and for the conversation to return to the more natural state we were used to; although, he seemed to speak more slowly and more clearly than I remembered during our everyday conversations. Throughout the interview he would maintain eye contact with me, much like a teacher maintains eye contact with their students, to make sure I understood what he was saying; it was clear he wanted to teach me about India.

Rajesh grew up in Bangalore and he described it as a city of socioeconomic contrasts, *especially now with all these jobs being outsourced to Bangalore, there's a lot*

of money coming in ... but it doesn't help everyone so there's a wide gap between rich and poor. Rajesh's family was what he described as *lower middle class,* that his father

> *worked a dead-end job most of his life ... they* [his parents] *scrimped and*
>
> *saved and made sure I had a good education, that I went to the best*
>
> *schools because something my mother used to always tell me was, well we*
>
> *will not be able to leave you much by way of property or wealth but a*
>
> *good education is something you'll always have, that's the best thing we*
>
> *can leave you.*

Rajesh completed his undergraduate degree in Bangalore and decided he would go to work for a company in Bangalore that was based out of Los Angeles, California. He realized during his first year of work that he would not be able to be promoted within the company until he earned a graduate degree. He said: *I hit a glass ceiling because I was not qualified enough, I didn't have a Masters or a PhD and I realized that I had to come back to school if I wanted to get ahead.* Rajesh stated that he was driven to succeed because:

> *I have a bit of a chip on my shoulder. I'll be honest with you, I have a bit*
>
> *of a chip on my shoulder about where I come from, you know, my*
>
> *background.... I've had to work hard to get where I am and if anything it's*
>
> *affected me in a positive manner. It's given me this drive to succeed and I*
>
> *don't want to have the kind of job that my father had.... I understand that*
>
> *he sacrificed his dream so I could have a better future; I don't want that to*
>
> *go to waste and I don't want him to think that all his efforts were in vain.*

I have not asked him specifically, but I am certain that Rajesh must be proud of himself and that he believes his father's efforts were successful, because he is completing his doctorate degree and he has accepted an engineering position with a large firm in Salt Lake City, Utah. Rajesh was looking forward to relocating to Salt Lake City in part because of the work that awaited him, but as an added bonus, Park City, Utah is the site of the 2008 Sundance Film Festival and he was very excited about being able to actually attend the Festival.

I'm happy ... it's been a dream to go to Sundance, I've always wanted to go there ever since I heard about it because at Sundance all you do, it's a two week long event, and all you do is watch films day and night.

Educated in India

*Kindergarten, well, the way it works is, India has a population of over one billion right? So there's a lot of competition. Now, even at the kindergarten level there's a lot of competition, so to get into a school you actually have to get through, go through an entrance exam. Even at that age you have to go through an entrance exam and get interviewed, everything. So you actually start getting schooled when you're three or something at home, you know, you go through the alphabet, numbers, everything you're supposed to actually learn in kindergarten, you start doing that at **home**. So by the time you're ready for kindergarten, you're old enough to go to kindergarten, you already know everything that you're gonna be taught.*

"Is it compulsory for everybody to go into kindergarten?" *No, uh, I understand the way it works here is, you know, you **have** to go to school, public school, I mean at least to a public school so you **have** to be in school. It's optional in India.... I mean here you have these uh zoning laws and then you know you live in a particular area, you **have** to go to the public school in that area. It's not like that, so your parents choose, or you choose, where you want to go to school and in my case, now uh from kindergarten 'til fourth grade I went to one school which was close to my place and then for fifth grade, that was when I was 11, they had me transferred to another school, my parents. Now this was one of the best schools in the city, but the downside to it was I had to travel a long distance, I had to take two buses. But, you know, it was a good school so again you have to go through the entrance exam and the interview and all that.*

"And so you went from fifth grade" *up until tenth grade. So that's from 11 to 16 and then after that you have two years of what's called pre-university; it basically prepares you for university. So many of the classes, you know, physics and chemistry and math and biology, you take all these classes, it's more broad here at this point ... then of course if you **then** decide to major in engineering at university, again you have the entrance exam.*

"Who makes the curriculum decisions?" *The state, I **never** had a choice of classes until I actually came here; even at university, it's all fixed. It's all fixed by the state, what classes you're gonna take, how many every semester, everything, everything is fixed.*

*The school I went to was a private school so we had a fairly small class size. Now in India a fairly small class size means, uh, 50, anywhere between 50 to 60 that would be small by Indian standards. Now if you had a public school though you'd have about say a hundred students packed in one class. And you know the public school system has nowhere near the kind of money that public schools here have. I mean I **do** know that it's still short, they still run short here, but the state in India has nowhere near the kind of money invested in the public school system that they have here. Which means no resources; you have a hundred students packed in a classroom, it's usually, most public schools in Bangalore, they're located in a dilapidated building, poor, teachers aren't paid on time so sometimes they don't have teachers for certain subjects which means that they don't have classes and they just basically have to study on their own. But not everybody can afford private schools. Public schools, they're more or less free, you just have to pay a nominal amount.*

Rajesh spent some time describing the courses students take during their primary and secondary education. Mathematics is emphasized throughout schooling. Rajesh explained to me that mathematics is important:

Especially if you're male, in India. You're expected to be good at math. Classes are *very structured, there's a lecture followed by homeworks, homework every day and you know in India we still believe in corporal punishment, so you'd **better** do you homework. If you were punished, well you know, you didn't go home and tell your parents because you don't want them coming in and talking to the teachers, it was very embarrassing, so if you were punished you just took it, you didn't go home and talk about it. If you had a bruise, well you just said you fell while playing soccer.*

*Yeah, like I say, it's **very** structured... You didn't even have freedom to choose where you were gonna sit ... you lined up in front of your classroom and your teacher would tell you where to go sit, that would depend on your height. The shorter kids sat closer to the front and the taller kids went in back. And you **stayed** there the entire year.*

<u>Engineering -- the Safety Net</u>

"You mentioned the other day about liking film school." *Oh yeah, that was something I wanted to do when I was 17 or 18 but you know it wasn't a safe choice there. I mean there's no safety net there, film, and I realized that film school is something I could do whenever I wanted to, even when I was 40 I could go do that. But I wanted to have a safety net; engineering was my safety net. With an engineering degree you can always get a job in India.... The decision had been made when I was nine.*

When I was nine I'd been told by my parents, you're gonna be an

engineer, you know we're a middle class family, you need a safety net and

that's gonna be it, engineering. All I had to decide was what I was going

to major in. I picked mechanical engineering because I was interested in

physics and math.

Why the United States?

Well a graduate school in India is not really very rigorous. I knew it had

to be either here or the UK and the UK would have been more expensive

so I looked at all the schools that I could afford and then schools that I

wanted to go to, schools that had programs that I was interested in and

Arizona State, you know, fit the bill.

What's Next...

I have a job in Salt Lake City so as soon as I graduate I plan to move there

and start working.

Sagar

My interactions with 26 year-old Sagar were always very business oriented, short

and no-nonsense. I really had no sense of what his personality was like. I always thought

of Sagar as one of the most serious engineering graduate students, and I have known him

for two years. He was the only MAE engineering graduate student, at the time of the

interviews, who received his undergraduate education at one of the premier IIT (Indian

Institute of Technology) schools. When he arrived for the interview he was extremely relaxed and the most laid-back that I had ever seen him. I turned on the video camera to record the interview, and he immediately started making funny faces at the camera; I burst out laughing because I was totally taken aback by this unexpected jester attitude; however, it was delightful to see that he had such a sense of humor. My curiosity was piqued; I had no idea what stories to expect from this person whom I knew nothing about.

Sagar's family moved extensively, mostly throughout Northern India because his father is an engineer and his work required that he move around in the field. He explained *I'm more like North Indian, I'm more a New Delhi kind of guy*. Sagar's family is a *business class family* and lives *in a joint family format*, his grandparents, three uncles, their wives and their children as well as Sagar, his parents and his sister lived together in a large house until his father's job required that his immediate family members (parents, sister and Sagar) move.

Sagar was the only participant I interviewed who had attended both public and private primary schools, all of the other participants attended private schools exclusively. I had heard and read reports from several sources regarding the poor state of education in Indian public schools, so I was surprised to hear that Sagar studied in a public school and yet was able to gain entrance to an IIT university. This was going to be another interesting interview and I was looking forward to hearing about his experiences. He also enjoyed having the opportunity to reminisce about his childhood. For example, we were talking about the location of his school, the distance from his home, and he said that *there used to be a bus that would come around and pick me up ... you're rekindling all my memories,*

he giggled and continued *it used to rain and my mother used to drop me when it rained and we'd go with the umbrella and everything.* You could see it in his eyes as he spoke that this was a personal and fond memory; I was glad to have been able to rekindle this kind of memory and I wanted to leave it as such.

The surprises Sagar has in store continue to surface; recently he stopped by my office to thank me for everything I had done to support his graduate education. He had completed his Master of Science degree and he was leaving the next day to pursue his doctoral work in Boston. During all of our meetings it was never mentioned that he was married; so again, I was somewhat stunned when he introduced the beautiful young woman with him as his wife.

The Educational Backbone in India

*In India, the educational system is broad in the sense that there are so-called "boards" like educational boards and there are some central boards which are like you can say federal boards, and there are some state boards which are like local to a particular **state**, and there are even further down the line, you can also have like district boards which are more like county boards you can say, so I'll use this analogy.*

Private schools have the liberty to choose which board of education that they want to provide in their schooling because they are private. And, the boards are basically there because in state schools they want, uh the school believes that they want to educate their students in their local language, in their local dialect, so their board of education

*caters to that kind of need. But the central boards are more or less English medium now in the sense they have strong focus on English and they're, the two main, or I would say there are the two boards. Central boards and **most** private schools are say good or "elite" schools and even the best public schools are affiliated to either of these two boards. And the one is known as the ICSE ... this board was started from the British and the British missionaries; all the schools that were started by the British missionaries, even after independence, many of the missionaries stayed and all the schools which belonged to those missionaries were affiliated to ICSE boards and **now**, even now a lot of other schools have also got affiliated to ICSE boards. And the second board which is more of like the board which was started by the government of India was the CBSE board.... And this is like the most popular and most common educational system that exists in India. I would say approximately, it's my guess, roughly 60 to 70 percent of schools right now might be affiliated just to this board.*

*And most schools, even ICSE schools are reverting to this board because this is like now the central board. And they have slight difference in terms of the curriculum. ICSE board is more focused on **English** education right from the beginning and CBSE board is like, it has a good component of English but it also has more Hindi which is the national*

language and Sanskrit which is like the mother language. So these are the

two primary boards. My primary education ... I studied in CBSE board.

"How many kids were in the classes there?" *I remember my class*

strength was around 45. There are teachers for every subject. There were

very few teachers who taught more than one subject but the ideal case, or

the general case is that there are teachers for different subjects. We had a

single classroom and the teacher used to come by rotation.... So each

period a techer used to come, she used to teach and then she used to leave,

there used to be a bell that used to ring, means end of period. There was

like a nine minute break.

Private versus Public in India

It was a major transition, the whole system was changed in the

sense, my primary school was like an elite school which had like students

coming from upper middle class or aristocratic families which were there

too, it was a more "Englishized" school with the principals and they were

like Christian missionaries, most of them Irish, so it was more in an elite

kind of environment and the feel of it very high and everything. Whereas

when I went to the public school I remember there used to be a bench

which was like three feet wide and there was supposed to be like three

students sitting on that common bench, sharing the bench, and the bench

used to rock it was an old bench and there was a small desk. Some of my

closest buddies were sons of either sweepers or cab drivers, I mean so it

was a major difference, it was a major difference in terms of my social interaction with others, the kind of teacher I faced, the kind of educational system I faced for a few years.

And I think it was an excellent learning experience because I realized my cultural environment more closely, I mean what is India. India is very diverse and there's a whole range of cultural environment you can experience and financial or economic classes that survive in India. So I had that opportunity to study in a place (motions high) *where the education was like the best education in terms of giving me modern and internationalized education whereas I also had the opportunity to study where it was more local and more, more "Indian" as such.*

Pursuing Engineering

I think the seeds were sown right in the beginning because my father was an engineer; he used to work in an engineering firm and he used to travel. We used to travel with him ... so I think the seeds were sown right in the beginning; I grew up in that kind of an environment and those were the things that excited me, you know building things, but I want to do engineering came probably when I finished, uh, when I was in grade ten which is like finishing off secondary school which is like two years before you complete your high school, pre-university. So that was the time when I decided okay I have to go for engineering and I have to prepare for it because doing engineering in India is not an opportunity that everybody

can get if he wants to get it. It is very, very competitive and typically if you

*want to go into the **best** engineering colleges, which are four or five, you*

spend like two years, two to three years or four years preparing just to get

entrance into that college.

So I decided I would start preparing for engineering. I prepared

for two years, by the time I was out of high school I gave the competitive

exams and worked through college. I was sixteen. I think my parents never

really put me into a situation where I felt I am being pressurized by them

or they are trying to delegate or trying to impose any of their personal

beliefs on me. Because as I said, I mean the seeds were sown right from

the beginning, like right from my childhood the way my personal

development was going on ... I was like led to engineering by my own

motivations and my own cultural imports there or environmental input. So

I didn't face any sort of dilemma or any kind of a conflict. I was just lucky

that I didn't face any kind of a conflict in this regard, it just came to me

naturally. So I didn't have to face the situation where I had to sit with my

parents and do some counseling goes on, okay I want to be an actor and

they say oh no, no, no.

While I was studying in school, getting all the school education, I

had also joined another tuition center where I used to study preparing for

engineering because although the syllabus was the same, the standard of

questioning was very different because it was a competitive exam and I

had to put more hard work and more the subjects of science. I used to go

to a private tutoring center.

After grade ten you get divided into broadly three areas. One is the

science, the other is economics, and third is humanities. So you choose

either of these three and again this becomes very competitive because

science is like the most sought after area so most students who get highest

marks or get good grades and everything. I did it as my choice but it so

happens that these things get divided more or less by merit. By which you

have merit and science and economics are almost equal in merit now these

days but like ten years ago it was the sciences where the most meritorious

used to go and then mediocre would take economics and the ones who felt

left behind would take humanities because there were no jobs.

So it was a natural inclination towards the subject but to be very

honest, once you give competitions then you get your rankings and the way

admissions happens, in the class of schools I went to is known as the IITs.

There are like five IITs which have like a common joint, JEE which is one

of the joint entrance examinations so you sit in the examination. There are

like almost a hundred thousand, a hundred fifty thousand people who sit in

that examination and around twenty six hundred qualify to study in those

*five IITs so that's the ferocity of this exam. So **then** you have like ranking*

so that you're ranked one through twenty six hundred and then they do a

counseling where they would call you, interview you rank wise and then

you would choose your discipline and the place where you want to go; so there are like five IITs and each IIT has like ten disciplines of engineering. So rank one, they call for rank one, okay which place do you want to go? Which discipline do you want to study? And he must choose and he will go there and that's how they will keep filling all the seats. So by the time say guy five hundred comes, he's left with limited choices. Say he wants to study computer engineering in Delhi, but he cannot because the seats have already been filled. So he will have to choose from the available seats or just not study at IIT. So it's your interest, but it's also, you have to decide, right in like five minutes where you have to study and so you have to be very flexible.

It so happens that the highest, the most highest ranked students, they choose computer engineering because computer engineering is the most sought after engineering because it leads to, at least 'til five years ago and there was like the boom in this field and it's still going on ... the best of the jobs are in computer engineering or electrical engineering. So it's like frame of mind, it's like an environment feed, so if you're highly ranked you're more inclined by your environmental factors to choose computer engineering. I don't blame it on the student who chooses it because he has not been exposed to engineering so far, so he doesn't know exactly what he's gonna come across when he studies engineering. So by looking at the people around him, say his uncle living next door is a

computer engineering whose working at Intel and he's very well off. So

when he sits with his parents they will say oh become a computer

engineering. So it becomes like that. But in my case, my ranking was like

four hundred and seventy five and it was like a perfect ranking to get into

a mechanical engineering course in New Delhi ... so when my ranking

came it so happened that my ranking was such that I could get mechanical

engineering and I was interested in mechanical engineering because of my

childhood experiences so I was just a best fit there.... I feel mine is not a

very general case because that's how the system works in India. So it may

not be the case that one who studied mechanical engineering studied

because he was just interested in it. And if he's saying so he might not be

saying the whole truth.

There are like hundreds of engineering schools probably that are

being opened up every year. They're adding up every year in India so it's

like, I would say it's like an educational boom which is going on....

There's a huge demand of engineers and when I say huge demand of

engineers there's like demand of highly skilled engineers, like all the let's

say academically smart kind of engineers and there's demand for

engineers who are smart in terms of management and stuff, and there's

demand for low skilled engineers too for running at a the level of

supervisors and field engineers and of that sort.

Why the United States?

While I was in my final year I got the inclination towards solving more academic problems and I was doing my undergrad thesis .. many of the toppers or say the highest ranked students of various departments who are more academically oriented, they will give the GRE and would pursue their graduate studies in the US because US has the best educational institutes and the best infrastructure for graduate education. And, most of our professors are also trained by American trained professors from Stanford, MIT, so the inclination started in my final year. I wasn't a very serious student the first two years, I was average student, I used to take part in all of extracurricular activities and so that kept me busy, kept me motivated, so my motivation's changed but by the time I had completely realized in a sense, I was already about to finish my undergraduation and so the immediate decision was to take up a job. So I worked in CocaCola Company. I worked for Coke for like 10 months and then I just quit the job because I wanted to do more. I wanted to stay in academic because I like more intellect, more kind of intellectual environments, I feel it is more like me. So I immediately skipped that but then I came back to IIT. A professor took me as a research assistant for around four months and I started applying, I started giving GRE. I immediately got a research fellowship ... in Netherlands, so they gave me like a fellowship for one year. It was a project which was like a consortium between the University, one of the

University professors and a DNO which is like, which is analogous to say

NSF in the US so it's like their research organization that funds projects.

So they had like a funded project and they wanted like a junior scientist

kind of a person, so they just hired me and it was like a job for me. So I

got that and I saw that as a good learning opportunity and I went there

instead of just entering to grad school. I was like, because everybody goes

to US I want to go to Europe and see Europe so it was like you want to do

something different first. So I went there and I spent one year; I had the

option to do a PhD over there but when I went there I realized, I mean the

educational system of the US is very much the way we are brought up and,

I mean, that's like borrowed from the American system where you have the

graded GPA, you have the course structure and everything's like more

very set up; it's like a very set up kind of environment whereas in Europe

it's more like uhm, not so much like a set up environment. It's more free

you know ... so that's what I felt is lacking there, that's why I decided,

okay, I'd do my grad studies in US. It's also safer to do grad studies here

because say you do your PhD from Stanford, you get a brand value,

***everybody** knows where that is, if I was getting a PhD from Leuktra, okay*

I could have got a good career out of it but it wouldn't have been a risk-

free option. So it's like okay, let's do something which is good, which

makes me feel safe.

What's Next...

As of now I'm looking forward to join an academic, uh I want to have an academic career, I want to be a professor. I will definitely want to return to India, I would love to go there but at what point of time is not certain yet.... I know there would be problems after living so long in the US, there would be certain adaptability problems that I might face and at this moment I am prepared to face them ... but by the time I complete my PhD I might change but I'm not rigid in that matter that I would stay here or I would go there. It is more like an open ended question for myself

CHAPTER FOUR

Additional Insight Regarding the Educational System in India

The Cream

They are only three and four years old and yet the competition to become successful adults has already begun. In India, parents dream that their little ones will become medical doctors or professional engineers as the children work to perfect the skills necessary to successfully pass the entrance examinations and interviews to enter kindergarten. India is a country with a population of over one billion people who occupy a land area approximately one-third the size of the US. Competition is fierce and begins early.

> Three-year-olds are carrying up to 11 textbooks in their school bags and do
> at least one hour's homework a night.... While primary schools across the
> country are debating how to reduce the academic burden on children,
> middle-class parents are demanding more homework for pre-school infants
> ... ambitious parents frequently insist that pre-schools give their children a
> formal education to prepare them for admissions tests in English and
> maths for good schools (Behal, 2003).

Gaining admission to a good school is of paramount importance; especially if the students, or their parents, expect them to be able to compete and become part of what three of my participants called "the cream". Many private schools are considered good schools in India because the quality of education in the public schools is extremely poor.

India has an educational emergency on its hands.... Last year [2006],

Pratham, an NGO [non-governmental organization] active in improving

primary education in India, published its first Annual Survey of Education

Report (ASER). The results were a damning indictment of the abysmal

quality of education available to most Indian children. Of an estimated 140

million children in primary school in India, Pratham finds that 30 million

cannot read, 40 million cannot even recognize an alphabet, and 55 million

will not complete even four years of school (Kamdar, 2007, p. 203).

Thus, private schools generally provide the type of education required to become part of

the cream. Regardless of whether students are enrolled in public schools or private

schools, the first milestone for Indian students is achieving a sufficient score on a

national, high-stakes tenth grade examination to move on to the next level of competition,

that being the science stream for pre-university studies.

Linear Education

Terms such as national and standardized are suggestive of a linear ideology with

respect to education; each level must be mastered before the student is allowed to move

on to the next level. It is a model of efficiency and in India, with a population of over one

billion people, efficiency is a keyword for many aspects of society, including educational

curriculum.

Curriculum is about designing learning within institutional contexts,

which means that practicalities of organization involving large numbers of

people and agencies have to be thought about (Reid, 1992, p. 18).

Fundamental to a linear philosophy is the prototype; you must know what the ideal product looks like in order to make a prototype, and you must have a prototype before you can set up the assembly line to manufacture the final product (Barone, 2005). The ideal final product, the prototype, in Indian society is the professional engineer. "For many families, getting a child into engineering college is something of a life's mission: A degree is considered a ticket to wealth and success" (Honawar, 2005, ¶ 10). Professor Rao, who is the Head of the Science Advisory Council to Prime Minister Manmohan Singh, agreed. He was quoted as saying that "all parents want their children to be engineers…. They will send them to just any engineering college, even if it doesn't have proper infrastructure or faculty" (Mooney & Neelakantan, 2006, ¶ 20).

The efficiency model of education is also known as the "school-as-factory" model, which comprises a linear ideology of education and focuses on teaching students how to be employable. In India, being employable means being competitive enough to pursue a career in engineering, or the "safety net" as several of my participants called it. Thus, training and preparation is centered on perfecting the skills that will enable these academic athletes to become part of the cream. The educational assembly line is established with a primary focus on mathematics and science, for perfecting those skills is the only path that will open the doors to be able to compete in the science stream and pursue the safety net. Amrit Dhillon (2005) stated that:

> Middle-class Indian families tend to abhor all subjects except medicine,
> engineering, accountancy and law. Since knowledge is considered a means
> to an end, not an end in itself, they see no reason to take a risk with say,

anthropology when they are guaranteed a good job in medicine or

engineering (¶ 13).

Guru

The participants in my study unanimously reported that the mode of instruction

throughout their schooling was teacher-centered and lecture based; a model of instruction

consistent with a linear pedagogy. I asked all of my participants if they ever experienced

any hands-on activities in their classes, a question that most of them could not

comprehend. Some of them paused as they tried to reflect back to their childhoods; if they

were able to recall a specific example they spoke about kindergarten activities, knitting

classes, poem writing or story-telling.

Teachers are to be respected in India; they are the purveyors of information, they

are the experts. There is a Sanskrit saying "Maatha, Pitru, Guru, Davia" which literally

means "Mother, Father, Teacher, God". (Note that the spelling is different from what

Karthik indicated. Karthik explained to me that *the two variants are in two different*

languages.)

It is not the words that are significant, it is the order in which those

four words are joined. What does this order signify? It prescribes the order

in which respect is due from a student ... in the order of respectability, the

place of the teacher precedes the place of god (Srinagesh, 2004).

In Indian tradition, the "Guru" (teacher) has a very important place.

The word Guru is made of two parts: Gu means darkness or ignorance and

Ru means dispeller or remover. Thus Guru literally means remover of

ignorance. The student or "Shishya" gains knowledge from the guru. The Vedic adage, "Matha, Pitha, Guru, Deivam" (mother, father, teacher, God) places the teacher before God and immediately after one's parents. A special day "Guru Poornima" is dedicated to the Guru (Vasudevan, 2002, ¶ 3).

Some teachers and administrators may believe that this level of respect provides them certain entitlements when it comes to the children. Four of my participants mentioned corporal punishment in the schools and more recently, a news article dated August 4, 2007 reported:

> In a shocking incident, the principal of a school in Andhra Pradesh gave electric shocks to a 10-year-old student.... When parents approached the principal, he reportedly justified his action saying this was aimed at improving her academic performance ... a case was registered against the principal and the police were looking for him.... The incident came close on the heels of another one where a schoolteacher allegedly pushed a five-year-old student so hard that he injured his tongue badly.... Last month, the head master of a private school in Mahabubnagar district was arrested for allegedly chaining a Class III student as punishment (*The Times of India*, 2007).

M. Sridhar Acharyulu, a Professor at Nalsar University of Law said:

> The corporal punishment is a regular affair in thousands of schools everywhere.... There are three types of corporal punishments in schools.

Physical punishments [12 types listed including caning, pinching and twisting the ears]; Emotional punishments [8 types listed including humiliating and removing the shirts of boys]; and Negative reinforcement [20 types listed including locking students in a dark room, and cleaning the premises] (n.d.).

An internet search can reveal that there are a large number of recent reports regarding corporal punishment despite an article in the January 15, 2004 edition of *The Times of India* that, at least in New Delhi, things should be changing.

The modified version of the Free and Compulsory Education Bill contains a provision banning corporal punishment in schools and proposing strict action against erring teachers and schools ("New Bill Takes Stick to Corporal Punishment", 2004).

A Dangerous Situation

Measurement is a central tenet to the linear model of education. However Kelly (2004) argued:

The term 'measurement' brings with it connotations of accuracy and precision, but it is plain to anyone who will look more closely at the matter that there is little accuracy or precision in most forms of assessment.... And this feature of assessment becomes particularly crucial, and dangerous, when far-reaching decisions concerning a pupil's future, career or further educational provision are being made on the basis of such questionable data (p. 127).

In India, tenth grade examination marks determine a student's future career path. When students meet or exceed a set standard, they become part of the cream and enter the highly valued science stream as they matriculate to pre-university studies. Students who have not earned a meritorious ranking sufficient to pursue the science, commerce or arts/humanities streams do not have an opportunity to further their education. "Dangerous" is an appropriate term for thousands of teenagers, because the pressure is too much to bear and they view suicide as their only option. A news article dated April 15, 2004 reported:

> Two years ago, the National Crimes Bureau noted that out of every three cases of suicide reported every 15 minutes in the country, one involves a youth in the age group of 15 to 29 ... the National Crime Records Bureau has one main reason for the increasing suicide rate in the country: "Family problems".... Psychologist Matthew Kurien of the Southern Medical Centre, Bangalore, agrees. "In this modern age, Dr. Kurien says, children are not brought up peacefully. They are under pressure to deliver at school; they are under pressure to appear for competitive examinations...." Dr. Kruien's argument is borne out by the fact that every year, when the results of secondary and intermediate school examination are announced, counselling centres across the country are flooded with distress calls from students. "I get hundreds of calls from students who are contemplating suicide because they could not achieve the good scores expected by their parents," says Elizabeth Vadakkekara, co-ordinator at Thrani, a

counselling centre in Thiruvananthapuram ("South India: World's Suicide Capital", 2004, ¶ 10).

On May 26, 2007 *The Times of India* reported that in Kanpur:

> Failure to clear the CBSE Class XII exam claimed its first victim this year when Pawan Verma (17), after checking his results in a cyber cafe and finding that his name was not on the list, shot himself dead on Friday morning with his father's revolver.... A suicide note addressed to his father Ashok Verma said the failure to clear the exam was the only reason behind his taking the extreme step.... Pawan's uncle said, "it was hard to believe the Pawan failed to clear the exams, and even more shocking was what he did" ("Teen Commits Suicide After Failing in CBSE Exams", 2007).

The tenth grade examination plays a significant role, not only in terms of curriculum decisions, but also in shaping the culture. The quest for individual achievement creates a highly competitive, even dangerous, environment for students. Attaining a meritorious score on the exam to be able to successfully complete the first level of competition and place students in the coveted science stream may require employing the resource of tuition. Tuition is a tutoring industry that has been created to meet the demands of parents and students in an effort to give them every possible advantage. Math and science teachers are hired by parents to provide tutoring to their children outside of school hours.

While the substantial sums involved in tuition are tilting the financial

scales of whole families, the pressure of intensive learning or "drilling" for

long hours of the day coupled with the fear of falling short of the targeted

score has been creating new tensions in the minds of the young students

("Raising A 'Tutored' Generation", ¶ 4).

"Students spend hours each day, seven days a week, attending coaching classes where

they are repeatedly drilled and tested in math and science, the two subjects they must

master to make it through the grueling entrance exam" (Honawar, 2005, ¶ 14).

"Gate-keeping" is a term used when access to something is being controlled; and

it can take many forms such as discrimination based on race, class, caste or gender.

Assessment can also serve a gate-keeping function. Eisner (1993) argued that assessment

is utilized for many purposes and that gate-keeping serves one function of assessment.

However, in India, gate-keeping is the primary function of assessment because the tenth-

grade examination scores sort students into allotted paths based on merit. Students who

fail to receive a test score competitive enough to pass the first milestone are not allowed

to pursue the second level of competition, the pre-university studies, and the dream of

becoming an engineer has morphed into a nightmare. "Any loss of percentage in the

required subjects [notably mathematics and science] by even a decimal point has become

to mean doors closed" ("Raising A 'Tutored' Generation", ¶ 3).

Indian students throw themselves into the study of science, math, and

technology.... On the student's part, it takes a total commitment and even

an obsession with learning to beat the heavy competition for a limited

number of seats" (Honawar, 2005, ¶ 11).

However, commitment by the students is not enough for some. Many parents and students

become so concerned about being able to pass through the gate and pursue a career in

engineering that there is a "do whatever it takes" attitude.

> Senior academics are warning that students are resorting to ever-more
>
> expensive means of cheating to ensure success in competitive
>
> examinations.... Mafia-style criminal gangs are selling leaked question
>
> papers to desperate Indian university students (Verma, 2006b, ¶ 1).

And, the tuition industry is "exploiting the helplessness of parents who fail to get booking

from reputed tutors" ("Raising A 'Tutored' Generation", ¶ 4).

The Next Gate

Regardless of whether a student attends tuition, receives assistance from family

members or works hard as an individual, successfully passing through the gate of the

tenth grade examination into the science stream does not end the competition. True to the

linear model, as soon as one level is mastered, there is another level toward becoming the

prototype. Students in the science stream for pre-university studies (eleventh and twelfth

grades), must now enter a new competition and strive to make it through another gate –

obtaining a seat at an engineering college, the second milestone. The pinnacle of this

competition is to obtain a seat at one of the prestigious Indian Institute of Technology

(IIT) institutions. The quality of engineering schools varies; however, one constant that

remains unquestioned is the quality of the IIT schools; they are the premier engineering

schools of India. "Put Harvard, MIT and Princeton together, and you begin to get an idea of the status of IIT in India" (Klug & Flaum, 2006).

Other than for IIT schools, there are three ways to obtain a seat at an engineering college: First is determined by the student's ranking earned on the twelfth grade examination; second is if the student comes from a very poor family, from a lower societal caste; and third is to purchase a seat. To earn a merit seat, students adopt the same strategies and techniques that earned them entrance into the science stream. They commit themselves to their pre-university studies which are focused on mathematics and science, they continue to attend tuition, and they work hard to make the dream of gaining admittance to an engineering college a reality. A number of seats are reserved at each college for those who are born into a lower caste.

> Lower castes are guaranteed certain proportions of government jobs and
> university admission slots. As a result, caste designations have become
> highly politicized.... Affirmative action in India has taken the form of
> quotas or reservations (Kamdar, 2007, p. 233).

The percentage of reserved seats for lower caste students may vary; however, the participants in my study agreed that it is around fifty percent and Verma (2006a) concurred:

> A law passed by parliament in January proposed the reservation of an
> additional 27 per cent of places for members of "other backward castes",
> on top of an existing 22.5 per cent for the lowest – Dalitas
> ("untouchables") and tribal communities (¶ 8).

"These reservations are said to be a cause of heartbreak among many. Many students with poor marks manage to get admissions, while meritorious students are left out" ("Education in India", ¶ 36). Three participants in my study expressed their disappointment with the reservation system. These participants worked extremely hard to earn their seats in engineering schools and explained that the competition to attain a seat is made even tougher when the number of available seats based on raking is reduced because of the mandated quota. Therefore, approximately 50 percent of the seats are available for students trying to earn one based solely on their twelfth grade examination scores. However, that number is actually less because "wealthier students who fail to make it through the entrance exams can choose to 'buy' engineering seats with large donations to a college" (Honawar, 2005, ¶ 34).

> The general corruption prevalent in India is also an issue in the Education system. Engineering, medical and other lucrative seats are sometimes sold for high prices and ridden with nepotism and power-play ("Education in India", ¶ 37).

All of the participants in my study explained the process for gaining entrance into an engineering college and selecting which branch of engineering they studied. Unanimously they reported that the highest ranked student is asked where he/she wants to study and what he/she wants to study. The student makes a selection, the seat is filled and the process continues down the line until all the available seats are filled. Ten of my participants said that the system does not allow you to just choose mechanical engineering, it generally depends on your ranking.

Escape

The test-driven, efficiency, linear model of education in India utilizes a lecture-based, rote memorization mode of instruction.

> Modern education in India is often criticized for being based on rote
>
> learning. Emphasis is laid on passing examinations with high percentage.
>
> Very few institutes give importance to developing personality and
>
> creativity among students ("Education in India", ¶ 33).

The participants in my study indicated that regardless of the grade level, testing was standardized, multiple-choice and designed with only one correct response. Eisner (1993) argued: "The tasks used to assess students should reveal how students go about solving a problem, not only the solutions they formulate" (p. 226). However, in an interview with Amrit Dhillon (2005) Sam Pitroda, Head of the Indian Government's New Knowledge Commission explained:

> Indian society is full of rules and rituals for every occasion and situation.
>
> From an early age, children learn to obey these rules. It means they don't
>
> think for themselves.... Even at university, students memorise information
>
> and are not taught to think critically. There is no tradition of
>
> experimenting. Indian society does not reward failure – its not seen as
>
> worthy or admirable. It rewards only success, and that discourages people
>
> from trying (¶ 11).

An educational system where students follow the rules, memorize information and regurgitate that information on a high stakes examination does not provide valuable

information to teachers or curriculum developers and "deflects it from ends which are

genuinely educational" (Kelly, 2004, p. 128). de Nicolas (1989) suggested: "We must

analyse those acts we perform to become educated and not stop short by imposing certain

habits of mind we have inherited, and thus act against the education of the young" (p.12).

The one correct response type of testing, such as the tenth and twelfth grade standardized

exams in India, make it:

> Impossible to determine the quality of reasoning or the process of
>
> thinking, the answers considered and rejected, the hypotheses formulated,
>
> or the explanations entertained in scoring the student's answer.... Indeed,
>
> it is quite possible for a student to arrive at a correct answer for entirely
>
> irrelevant reasons (Eisner, 1993, p. 227).

However, understanding a student's reasoning does not fit within the linear ideology of

education; the goal is to establish an efficient means of attaining the prototype. The

education system in India explicitly unifies and standardizes what is to be taught, how it

is to be taught and the way it will be tested. A report by India's National Knowledge

Commission "calls for smaller institutions that are more responsive to change, regular

reviews of curricula, and a new examination system that would test understanding rather

than memorization" (Neelakantan, 2007, ¶ 12). Regarding curriculum changes:

> In 2005, the Kerala government introduced a grades-based system in the
>
> hope that it will help students to move away from cut-throat competition
>
> and rote-learning and will be able to focus on creative aspects and
>
> personality development as well.... However, critics say even this is

memorized by students (or even plagiarized). This is attributed to pressure from parents who are eager to see high scores more than overall development ("Education in India", ¶ 26).

Politically, Kumar (2006) stated:

> The path to systemic transformation is a prolonged one.... Education
>
> needs to be located within this larger understanding of state and class....
>
> A critical pedagogy that locates education within the context of larger
>
> politico-economic analyses can serve as a tool of effective analyses of the
>
> concrete situation.... We cannot achieve the goals of equal schooling,
>
> which is being denied by the system based on aggressive expansion of
>
> profit seeking capital, unless we understand the character of the system
>
> (¶ 35-38).

Sociologically, Behal and O'Malley (2006) argued: "Fraud and corruption are seriously disrupting the Government's much-touted drive towards basic schooling for all of India's children" (¶ 1). Regardless of what philosophical position is being endorsed, changing an efficiency-based, linear model of education means changing or eliminating the prototype as well as the strategies employed to become part of the cream. Describing one perspective of curriculum, Reid (1992) adopted an engineering metaphor that appropriately portrayed this situation:

> In engineering, we want to design and maintain a whole system. But in
>
> order to do that, we need to know where the system begins and ends, and
>
> perhaps where and how it has to be coupled to other systems. And the

means of getting the whole thing to work is understanding the parts. If we

get the parts right, the system will run efficiently and do its job.

Breakdowns will be breakdowns of parts. Generally, we assume that the

overall design is good, because we took pains over that in the first place,

or we inherited a design that seemed to be working well. "Going back to

the drawing board" is something we don't really want to do unless we are

forced into it (p. 18).

Many lucrative opportunities await those students who have beat the competition,

successfully obtained a college degree in engineering and have become the prototype, the

highly respected professional engineer that their parents had dreamed they would be.

Thus, the safety net has been secured. Yet for many, such as those who participated in my

study, being part of the cream and becoming the prototype is not sufficient. They aim to

be the cream of the cream, the elite, and for those students, more competition and more

gates await.

Three of the students who participated in my research believe that they have

strong mathematical skills because the rote memorization method of learning has taught

them to be competent in computation. One reason many of my participants decided to

come to the US was to move beyond the world of memorizing facts and into the world of

applying knowledge to practical problems. Learning how to apply knowledge to real life

situations is a skill they do not believe they could have received if they stayed in India for

graduate study.

Pursuing graduate studies in the US is the final gate to ensure their success as a professional engineer. Many hope to obtain an engineering job and stay in the US for at least a few years, but almost all of the students who participated in my research study planned to return to India and believed that if they gain practical knowledge along with at least some US work experience it will enhance their opportunities to secure a better engineering job at home.

The Indian engineering graduate students who successfully complete their Master's or Doctoral degrees in the US and who have finally passed through all of the gates will now have an elite title; they will enjoy a higher societal status and, they will have extremely proud parents.

CHAPTER FIVE

Final Thoughts

India is a very large developing nation and the demand for engineers is

substantial. However, the number of engineering graduates in India may not be as

threatening to the US as the media has portrayed. Duke University (Gereffi & Wadhwa,

2005) researched the numbers of baccalaureate and sub-baccalaureate engineering,

computer science and information technology degrees awarded during 2004 in the US,

India and China. Their study found that the extensively reported 350,000 engineering

graduates in India included four-year bachelor's degrees, three-year training programs and

diploma holders. The Duke data showed that "per every one million citizens, the United

States is producing roughly 750 technology specialists, compared with 500 in China and

200 in India" (p. 7). Nonetheless the educational actions spurred by the hyperbole that the

US will not be able to maintain its technology advantage, have once again placed an

emphasis on improving mathematics and science education in the US.

The current model of education in the US, with the implementation of mandated

high-stakes testing, may not provide a path to educate our students that will produce

innovative thinkers as it has been moving more toward the linear model that students

from India are trying to escape. The participants in my research study indicated that while

the linear, rote memorization model of education they experienced in India may have

provided a foundation, it did not provide the means to apply their knowledge in real-

world situations and become effective engineers. As mentioned previously, Kamdar

(2007) stated that 80,000 students from India came to the US in 2005 to pursue their

graduate studies. More than likely one of the main reasons those 80,000 students decided to come to the US is the same reason most of my participants are here; that is, to gain an educational experience that moves beyond rote memorization of material for the purpose of successfully passing a high-stakes examination.

Implementation of No Child Left Behind (NCLB) in 2002 places tremendous pressure on everyone involved in public education and the decisions teachers make regarding instruction are important. Cimbricz (2002) stated: "State-mandated tests do matter and do influence what teachers say and do in their classrooms" (¶ 12). Barbara Reys *et al.* (2007), surveyed mathematics curriculum specialists from 46 states regarding implementation of new math curriculum documents that address specific grade level standards. Two representative responses were presented in their study:

> One respondent said, "Due to the increased testing and pressure on testing
> the standards are widely used and have become the driving force in most
> classrooms." Another indicated, "This document has already influenced
> what is taught in classrooms. State standards are no longer viewed as the
> document on the shelf. NCLB and the accountability requirement had a
> tremendous influence on this change." In fact, most respondents attributed
> the increased influence of the state mathematics curriculum document to
> factors associated with NCLB (p. 15).

To understand what students know requires a variety of pedagogical strategies regarding instruction as well as assessment. Yet, similar to the competitive, high-stakes tenth grade examination in India, high-stakes tests in the US are comprised mainly of

multiple choice questions. There is only one correct answer and the means of obtaining that answer are not relevant. The examinations are designed so that each question tests only one skill; therefore test content is reduced to a basic skills level which is not conducive to understanding.

Standards focus on basic skill levels and are rapidly changing the instructional styles of teachers, who are moving away from innovative methods, to more traditional ones of drill and recitation to ensure high-stakes test scores are raised (Burke-Adams, 2007, p. 59).

Teachers can become 'testing coaches' (Sacks, 1999) less likely to use innovative instructional practices such as cooperative learning, whole language, and higher order thinking activities (Sutton, 2004, p. 463).

Jere Confrey (2006) agreed: "High-stakes test construction also narrows the content, depresses the cognitive level, and encourages teaching to the test" (¶ 5). However, it is possible for teachers to find a balance between incorporating creative instructional strategies while at the same time preparing students to perform well on a standardized exam. "Determining the appropriate balance, which has implications for academic freedom and is always complex in core classes, is exacerbated under high-stakes testing" (Sutton, 2004, p. 468).

My research revealed that for thousands of students in India the pressure to perform well on the high-stakes tenth grade examination is so severe that they cannot cope with the thought of failing to meet the minimum score that will allow them to continue their education. The similar implications and consequences for students who fail

the high-stakes examinations imposed by NCLB in the US is a topic that we cannot afford

to ignore. In the year 2000, nearly 8,000 students were informed that they had failed the

mathematics portion of the Minnesota Basic Standards Test (MBST). However, there was

one major problem—scoring errors were to blame for the students' notification of

failure—yet, those students had actually passed the exam. Cornell, *et al.* (2006) surveyed

911 of the students that had been incorrectly informed of their failure to determine what

the psychosocial impacts were as a result of this "accident." While suicide was not

specifically mentioned in their report, their findings did indicate that there is reason for

concern:

> Many students were distressed to be told that they failed a high-stakes test.
>
> Although the extent of impact varied across students, the cumulative
>
> findings indicate that the majority of students in our sample were
>
> substantially affected by purported test failure. Students increased their
>
> studying and made changes in their extracurricular activities to retake the
>
> test. Students reported multiple negative emotional reactions, such as
>
> feeling depressed or feeling stupid, and in some cases endured unpleasant
>
> responses by their parents and their peers (pp. 740-41).

Other researchers have explored how high-stakes testing has impacted areas such as

student motivation, drop-out rates, test anxiety, etc. However, Cornell, *et al.* (*ibid*)

claimed that their Minnesota research was, to their knowledge, "the first published

findings regarding the socioemotional impact of being told that one failed an examination

required for high school graduation" (p. 741). There may well be some serious

unintended consequences of high-stakes testing associated with the emotional health of

students that warrants further investigation. Particularly since, as Cornell, *et al.* (*ibid*)

stated: "High-stakes testing affects millions of students, and current educational trends

and politics make it likely that eventually it will affect every student in the United States"

(p. 746).

NCLB requires that the results from high-stakes tests be made public in the form

of annual report cards; the information that is published ultimately results in newspaper

headlines. For schools that are labeled "excelling" teachers, administrators and the

community are praised. However, schools that are labeled "failing" are publicly shamed.

"In short, accountability becomes synonymous with a public display of judgment" (Foote,

2007, p. 360). Publicly labeling schools has a stigmatizing effect that directly impacts

teachers.

> Our society is predicated on meritocratic assumptions, particularly in
>
> regard to public education; therefore, failure to succeed in formal
>
> institutions such as schools is seen as within the control of those in
>
> charge—in this case, principals and teachers. According to attribution
>
> theory, this stigma is likely to be looked upon by observers negatively. In
>
> the case of teachers specifically, the general public assumes that low test
>
> scores mean that teachers have failed to impart the necessary tools for
>
> achievement; thus, the "low performing" label is seen to be indicative of
>
> their incompetence (Murillo & Flores, 2002, p. 96).

The fear of public embarrassment places additional pressure on teachers to raise their students' test scores. In a high-stakes environment teachers are more likely to transfer out of low-performing schools to avoid the attached stigma or abandon the profession altogether "because principals, who are also under pressure to obtain high … results, do not want to hire teachers who once taught at low performing schools" (McMillan, 1999, ¶ 3).

The call by the National Science Foundation to include an outreach component in submitted proposals has opened doors to bring engineering into the K-12 education system. Teaching mathematics and science in an engineering context does not imply that all students should become engineers. It does, however, stimulate curiosity in the classroom, it allows students to experience problem solving through hands-on activities; it connects how mathematics, science, and technology affect their own lives and how it can benefit society. Additionally, it may provide students with educational memories; unlike the participants in my study who were not able to recall any classroom hands-on activities except possibly in kindergarten.

There are lessons to be learned by examining the educational system in India and by examining the educational system in the US. It is not for me to state explicitly what those lessons are for we bring our own perspectives and our own personal histories with us. However, my research for this study laid the groundwork for future studies. There is much to be accomplished in terms of educational research and for me discovering innovative ways to improve mathematics education is of paramount importance.

It is ironic that students from India view the US educational system as superior and yet we are determined to go down a path of teacher-centered, rote memorization, high-stakes testing education; a direction that is not conducive to stimulating curiosity and innovative thinking. I agree with Eisner (1990):

> The creating of conditions that allow students to display their creative and reasoning abilities in ways that are unique to their temperaments, the experience, and their aims is of fundamental importance in any educational enterprise—in contrast to one concerned with training (p.759).

References

Acharyulu, M. Sridhar. (n.d.). Corporal punishment violation of child rights in schools. Retrieved September 20, 2007 from http://www.legalservicesindia.com/articles/punish.htm

American Competitiveness Initiative. (2006). Retrieved December 18, 2006 from http://www.whitehouse.gov/stateoftheunion/2006/aci

Barone, Thomas. (2005). Perspectives on Curriculum Course Notes.

Bakhtin, M. M. (1984). *Problems of Dostoevsky's poetics* (C. Emerson, Trans.). Minneapolis, MN: University of Minnesota Press.

Behal, S. (2003, May 9). Just an hour of homework – at age three. *The Times Educational Supplement*, p. 18.

Behal, S., & O'Malley, B. (2006). Fraud robs millions of basic schooling [Electronic version]. *The Times Educational Supplement, 16* (4071).

Bracey, G. W. (2006, May 21). Heard the one about the 600,000 Chinese engineers? [Electronic version]. *Washington Post.*

Bruner, J. (1986). *Actual minds, possible worlds.* Cambridge: Harvard University Press.

Burke-Adams, A. (2007). The benefits of equalizing standards and creativity: Discovering a balance in instruction. *Gifted Children Today, 30*(1), 58-63.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis.* Thousand Oaks: Sage Publications, Inc.

Cimbricz, S. (2002). State-mandated testing and teachers' beliefs and practice. *Education Policy Analysis Archives, 10.*

Clandinin, D. J., & Connelly, F. M. (2000). *Narrative inquiry: Experience and story in qualitative research.* San Francisco: John Wiley & Sons, Inc.

Coles, R. (1989). *The call of stories: Teaching and the moral imagination.* Boston: Houghton Mifflin Co.

Colvin, G. (2005). Can Americans compete? [Electronic version]. *Fortune, 152*(2), 70.

Confrey, J. (2006). Fuzzy policy, not 'fuzzy math,' is the problem. *Education Week 26*, pp. 30-31.

Cornell, D. G., Krosnick, J. A., & Chang, L. (2006). Student reactions to being wrongly informed of failing a high-stakes test: The case of the Minnesota basic standards test. *Educational Policy, 20*(5), 718-751.

Coulter, D. (1999). The epic and the novel: Dialogism and teacher research. *Educational Researcher, 28*(3), 4-13.

De Nicholas, A. (1989). *Habits of mind.* New York: Paragon House.

Dhillon, A. (2005). More than a billion people but where are the thinkers? [Eectronic version]. *The Times Higher Education Supplement, 1720,* 20.

Education in India. Retrieved May 28, 2007 from http://en.wikipedia.org/wiki/Education_in_India

Eisner, E. W. (1990). Standards for American schools – help or hinderance? *Phi Delta Kappan, 76*(10), 758-760.

Eisner, E. W. (1993). Reshaping assessment in education: Some criteria in search of practice. *Journal of Curriculum Studies, 25*(3), 219-223.

Foote, M. (2007). Keeping accountability systems accountable. *Phi Delta Kappan, 88*(5), 359-363.

Friedman, Thomas L. (2006). *The world is flat: A brief history of the twenty-first century.* New York: Farrar, Straus and Giroux.

Gee, J. P. (1985). The narrativization of experience in the oral style. *Journal of Education, 167*(1), 9-35.

Gereffi, G., & Wadhwa, V. (2005). Framing the engineering outsourcing debate. Placing the United States on a level playing field with China and India [Electronic version]. (pp. 1-11): Master of Engineering Management Program – Duke University.

Glaser, B. G. (1978). *Theoretical sensitivity.* Mill Valley, CA: The Sociology Press.

Gubrium, J. F., & Holstein, J.A. (1998). Narrative practice and the coherence of personal stories. *The Sociological Quarterly, 39*(1), 163-187.

Honawar, V. (2005). The great obsession [Electronic version]. *Education Week, 25*(13), 30-34.

Kamdar, M. (2007). *Planet India.* New York: Scribner.

Keeping America Competitive. (2006). [Electronic version]. *ASEE Prism, 15*(8), 18.

Kelly, A. V. (2004). *Curriculum theory and practice.* [Electronic version]. (Fifth ed.). London: Sage Publications, Inc.

Kemper, S. (1984). The development of narrative skills: Explanations and entertainments. In S. A. Kuczaj II (Ed.), *Discourse development: Progress in cognitive development research.* New York: Springer-Verlag.

Klein, A. (2006). Spellings joins passage to India on education. *Education Week, 25*(32), 26.

Klug, R., & Flaum, A. T. (Writer) (2006, January 27) Imported from India, best and brightest want to work in United States. [Television Broadcast Transcript]. *60-Minutes*: CBS News.

Kumar, R. (2006). State, class and critical framework of praxis: The missing link in Indian educational debates [Electronic version]. *Journal for Critical Education Policy Studies, 4*(2).

Kvale, S. (1996). *Interviews: An introduction to qualitative research interviewing.* Thousand Oaks: Sage Publications, Inc.

Lather, P. (2003). Issues of validity in openly ideological research: Between a rock and a soft place. In Y. S. Lincoln & N. K. Denzin (Eds.), *Turning points in qualitative research: Tying knots in a handkerchief.* Walnut Creek, CA: Alta Mira Press.

McMillan, M. (1999). The troubling consequences of the ABCs: Who's accountable. Retrieved July 14, 2007, from http://www.common-sense.org/abcs/index.html#contents

Mishler, E. G. (1986). *Research interviewing context and narrative*. Cambridge: Harvard University Press.

Moody, D. (2007). The use – and misuse – of statistics in evaluating the benefits of restructured electricity markets. *The Electricity Journal, 20*(2), 57-62.

Mooney, P., & Neelakantan, S. (2006). Foreign academics question the quality of their countries' engineering programs [Electronic version]. *The Chronicle of Higher Education, 53*(3).

Murillo, E. G. J., & Flores, S. Y. (2002). Reform by shame: Managing the stigma of labels in high stakes testing. *Educational Foundations, 16*(2), 93-108.

A Nation at risk: The imperative for educational reform. (1983). Retrieved July, 2007, from http://www.ed.gov/pubs/NatAtRisk/index.html

Neelakantan, S. (2007). Commission calls for overhaul of higher education in India [Electronic version]. *The Chronicle of Higher Education, 53*(21).

New bill takes stick to corporal punishment. (January 15, 2004). *The Times of India*. Retrieved September 20, 2007 from http://timesofindia.indiatimes.com/articleshow/423742.cms

No child left behind NCLB executive summary. Retrieved May, 2007, from http://www.ed.gov/nclb/overview/intro/execsumm.html

Polkinghorne, D. E. (1988). *Narrative knowing and the human sciences*. Albany: State University of New York Press.

Polkinghorne, D. E. (1995). Narrative configuration in qualitative analysis. *International Journal of Qualitative Studies in Education, 8*(1), 12-28.

Principal gives electric shocks to student. (2007). *The Times of India*. Retrieved August 8, 2007 from http://timesofindia.indiatimes.com/India/Principal_gives_electric_shocks_to_student/articleshow/2256205.cms

Raising a "tutored" generation. (n.d.). *OnlineBangalore.com/Life/Style/Family*. Retrieved January 4, 2007 from http://www.onlinebangalore.com/life/fami/tuition.html

Reid, W. A. (1992). *The pursuit of curriculum schooling and the public interest.* Norwood: Ablex Publishing Corporation.

Reys, B., & Lappan, G. (2007). Consensus or confusion? *Phi Delta Kappan, 88*(9), 676-680.

Ricoeur, P. (1973). The model of the text: Meaningful action considered as a text. *New Literary History, 5*(1), 91-117.

Rising above the gathering storm. (Executive Summary 2006). National Academy of Sciences, National Academy of Engineering and Institute of Medicine.

Schield, M. (1999). Statistical literacy: Thinking critically about statistics. *The Journal of Significance.* Retrieved August 17, 2007 from http://www.augsburg.edu/ppages/~schield/MiloPapers/984StatisticalLiteracy6.pdf

Seidman, I. (1998). *Interviewing as qualitative research* (Second ed.). New York: Teachers College Press.

Selingo, J. (2007). Cornell courts a subcontinent [Electronic version]. *The Chronicle of Higher Education, 53*(26).

South India: World's suicide capital. (2004). Retrieved December 17, 2006 from http://www.rediff.com/news/2004/apr/15spec.htm

Spradley, J. (1979). *The ethnographic interview.* New York: Holt, Reinhart and Winston.

Srinagesh, K. (2004). On teaching and learning in ancient India. *Newsletter of The Center for Indic Studies at the Univ. of Mass. Dartmouth, 4*(2).

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* Newbury Park: Sage Publications, Inc.

Sutton, R. E. (2004). Teaching under high-stakes testing: Dilemmas and decisions of a teacher educator. *Journal of Teacher Education, 55*(5), 463-475.

Teen commits suicide after failing in CBSE exams. (2007, May 26). *The Times of India.* Retrieved June 7, 2007 from http://timesofindia.indiatimes.com/articleshow/2075193.cms

Van Maanen, J. (1988). *Tales of the field: On writing ethnography*. Chicago: The University of Chicago Press.

Vasudevan, P. T. (April 18, 2002). Teaching the e-student: Paradigms, processes and problems. Retrieved December 17, 2006 from http://www.unh.edu/teaching-excellence/resources/pdf/vasudevan.pdf

Vaughn, S., Schumm, J. S., & Jane, S. (1996). *Focus group interviews in education and psychology*. Thousand Oaks, CA: Sage Publications, Inc.

Verma, R. (2006a). India goes for growth [Electronic version]. *The Times Higher Education Supplement, 11*(1760).

Verma, R. (2006b). India exam rocket [Electronic version]. *The Times Higher Education Supplement, 1729*, 13.

APPENDIX A

INSTITUTIONAL REVIEW BOARD DOCUMENTATION

IRB Approval

ARIZONA STATE UNIVERSITY

To:	Eric Margolis ED 120M
From:	Mark Roosa, Chair Institutional Review Board
Date:	10/20/2006
Committee Action:	**Expedited Approval**
Approval Date:	10/19/2006
Review Type:	Expedited F7
IRB Protocol #:	0610001169
Study Title:	Indian Engineering Students: It's Not Just the Numbers
Expiration Date:	10/18/2007

The above-referenced protocol was approved following expedited review by the Institutional Review Board.

It is the Principal Investigator's responsibility to obtain review and continued approval before the expiration date. You may not continue any research activity beyond the expiration date without approval by the Institutional Review Board.

Adverse Reactions: If any untoward incidents or severe reactions should develop as a result of this study, you are required to notify the Institutional Review Board immediately. If necessary a member of the IRB will be assigned to look into the matter. If the problem is serious, approval may be withdrawn pending IRB review.

Amendments: If you wish to change any aspect of this study, such as the procedures, the consent forms, or the investigators, please communicate your requested changes to the Institutional Review Board. The new procedure is not to be initiated until the IRB approval has been given.

Please retain a copy of this letter with your approved protocol.

CONSENT FORM
Indian Engineering Students, It's Not Just The Numbers

INTRODUCTON

The purposes of this form are to provide you (as a prospective research study participant) information that may affect your decision as to whether or not to participate in this research and to record the consent of those who agree to be involved in the study.

RESEARCHERS

Dr. Eric Margolis, Associate Professor, College of Education and Lynn Cozort, Doctoral student, College of Education have invited your participation in a research study.

STUDY PURPOSE

The purpose of this research is to learn about the cultural and educational experiences of Indian engineering students. There is growing concern regarding the amount of job outsourcing to India and the number of Indian engineering students competing for engineering education and engineering jobs. This study will qualitatively examine the backgrounds of students to gain further knowledge about what experiences have shaped their desire to pursue engineering as a career.

DESCRIPTION OF RESEARCH STUDY

Students who are citizens of India and currently enrolled in Mechanical and Aerospace Engineering graduate degree programs at Arizona State University will be sent a recruitment letter asking for volunteers to participate in this study. The participants will meet with Lynn to discuss their homes, their cultural backgrounds and their educational experiences. The interviews will be videotaped as well as audio taped. The researchers will code the data and protect the identities of the participants using pseudo-names, or referred to as participant A, participant B, etc.

If you say YES, then your participation will last for approximately three to five hours during the first interview session and one to two hours if a follow-up interview is deemed necessary.

RISKS

There are no foreseeable risks associated with your participation in this study.

BENEFITS

The possible/main benefits of your participation in the research are that you will have an opportunity to share your background and personal stories, fostering a sense of inclusion and an understanding that your cultural heritage is valued.

The possible benefits to others of your participation are that the information generated from this study could serve to engage more domestic students into an engineering curriculum and improve math, science and technology education.

NEW INFORMATION
If the researchers find new information during the study that would reasonably change your decision about participating, then they will provide this information to you.

CONFIDENTIALITY
All information obtained in this study is strictly confidential unless disclosure is required by law. The results of this research study may be used in reports, presentations, and publications, but the researchers will not identify you. In order to maintain confidentiality of your records the researchers will code the data as Participant A, Participant B, etc., and when names are necessary, a pseudo-name will be substituted. Your identity may be shared only with Dr. Eric Margolis, Lynn Cozort, Dr. Alfinio Flores or Dr. Joanne Bauman. No other individuals will be allowed access to the confidential data.

WITHDRAWAL PRIVILEGE
It is ok for you to say no. Even if you say yes now, you are free to say no later, and withdraw from the study at any time.

COSTS AND PAYMENTS
There is no payment for your participation in the study.

COMPENSATION FOR ILLNESS AND INJURY
If you agree to participate in the study, then your consent does not waive any of your legal rights. However, in the event of (harm, injury, illness) arising from this study neither Arizona State University nor the researchers are able to give you any money, insurance coverage, free medical care, or any compensation for such injury.

VOLUNTARY CONSENT
Any questions you have concerning the research study or your participation in the study, before or after your consent, will be answered by Lynn Cozort, ECG 343, 5-4979, lynn.cozort@asu.edu; or by Dr. Eric Margolis, ED 120M, 5-0131, eric.margolis@asu.edu.

If you have questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Research Compliance Office, at 480-965 6788.

This form explains the nature, demands, benefits and any risk of the project. By signing this form you agree knowingly to assume any risks involved. Remember, your participation is voluntary. You may choose not to participate or to withdraw your consent and discontinue participation at any time without penalty or loss of benefit. In signing this consent form, you are not waiving any legal claims, rights, or remedies. A copy of this consent form will be given (offered) to you.

Your signature below indicates that you consent to participate in the above study. By signing below, you are granting the researchers the right to use your likeness, image, appearance and performance – whether recorded on or transferred to videotape, film, slides, photographs – for presenting or publishing this research.

Subject's Signature	Printed Name	Date

INVESTIGATOR'S STATEMENT

"I certify that I have explained to the above individual the nature and purpose, the potential benefits and possible risks associated with participation in this research study, have answered any questions that have been raised, and have witnessed the above signature. These elements of Informed Consent conform to the Assurance given by Arizona State University to the Office for Human Research Protections to protect the rights of human subjects. I have provided (offered) the subject/participant a copy of this signed consent document."

Signature of Investigator_____ Date_____

Videotape Release Form Submitted to the IRB

Videotape Recording Release Consent Form

Protocol #: <u>0610001169</u>

Researcher(s): Dr. Eric Margolis and Lynn Cozort

Title: Indian Engineering Students, It's Not Just The Numbers

As part of this project, a videotape recording will be made of you during your participation in this research project. Please indicate below the uses of these videotapes to which you are willing to consent. This is completely voluntary and up to you. In any use of the videotapes, we will not identify you by name.

1) The videotapes can be studied by the research team for use in the research project.

<div style="text-align:right">_____
Initials</div>

2) The videotapes can be shown to subjects in other experiments.

<div style="text-align:right">_____
Initials</div>

3) The videotapes can be shown at meetings of scientists interested in the study of Indian engineering students.

<div style="text-align:right">_____
Initials</div>

4) The videotapes can be shown in classrooms to students.

<div style="text-align:right">_____
Initials</div>

5) The videotapes can be shown in public presentations to non-scientific groups.

<div style="text-align:right">_____
Initials</div>

6) The videotapes can be shown on television.

<div style="text-align:right">_____
Initials</div>

I have read the above description and give my consent for the use of videotapes as indicated above. I have also been given a separate consent form.

_____   _____   _____
Participant's Name   Participant's Signature   Date

<u>____Lynn Cozort_____</u>   _____   _____
Researcher's Name   Researcher's Signature   Date

Recruitment Text Sent via e-mail

I am a Doctoral student in the Division of Curriculum and Instruction at Arizona State University. I am conducting a research study to investigate the personal backgrounds of Indian engineering students. I am recruiting individuals who are citizens of India and are currently enrolled in a graduate degree program in Mechanical and Aerospace Engineering at Arizona State University.

This study will involve meeting with me for several hours on a Saturday or Sunday to discuss your home, your family, your culture and your educational experiences. The interview will be videotaped as well as audiotaped. Follow-up interviews may be necessary if, during the data analysis, I find that I need some clarification. The data I am collecting will be coded and your personal identities will not be revealed in any written documents (such as journal publications or my dissertation). The videotapes will be kept in a locked file cabinet for ten years. The audiotapes will be downloaded onto my personal computer for transcription purposes and kept on file for ten years at which time the files will be permanently deleted from my computer. The files will be erased from the audio recorder immediately after being downloaded onto my computer.

Your participation in this study is voluntary. You are under no obligation to participate and you may choose not to participate, or to stop the interview, at any time.

If you are interested in participating in this study, please send me an e-mail at lynn.cozort@asu.edu, telephone me at (480) 965-4979, or stop by my office in ECG 343.

If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Research Compliance Office, at (480) 965-6788.

Potential Interview Questions Submitted to the IRB

A list of potential questions is given below. However, this research will involve conversational ethnographic questions and while the interviews will range over this material it will not take this form and as the research develops additional issues will be explored.

Describe your educational background. What age did you start formal schooling? What subjects did you study? How many hours a day did you attend school? How did you become interested in engineering? Why did you decide to continue your education in the United States? What are you plans once you complete your degree at ASU?

Describe your personal background. Do you have any siblings? If so, are they younger or older than you? Are they in school now? What are their plans for the future? What type of work do your parents do? Do both of your parents work outside the home? Describe the geographical area where your home is located.

Describe some of your cultural beliefs regarding education. Is it mandatory for all children to attend school? Are they required to attend for a certain number of years, or until a certain age? Do students generally work while they are attending school? Describe what you see are differences between your educational experiences in India and your educational experiences in the United States.

Proposal Submitted to IRB

ASU

For Office Use Only:
Date Received: _____
HS Number: _____

SOCIAL BEHAVIORAL APPLICATION
HUMAN SUBJECTS

PROTOCOL TITLE: Indian Engineering Students, It's Not Just The Numbers		DATE OF REQUEST: 09/19/06
PRINCIPAL INVESTIGATOR: Eric Margolis	**DEPARTMENT/CENTER:** Curriculum & Instruction	**UNIVERSITY AFFILIATION:** ☐ Professor ☒ Associate Professor ☐ Assistant Professor
CAMPUS ADDRESS: *(including campus mail code)* Bldg/Room: Ed 120M Mail Code: 2411	**PHONE:** 480-965-0131	☐ Instructor ☐ Other: **Please specify.** ("Other" categories may require prior approval. Graduate Students can not serve as the Principal Investigator)
	E-MAIL: Eric.Margolis@asu.edu	

List all co-investigators. (Attach an extra sheet if necessary.) Co-investigators are responsible for any of the following: the project's design, implementation, data collection, and/or data analysis.

CO-INVESTIGATOR: Lynn Cozort	DEPARTMENT/CENTER: Curriculum & Instruction	UNIVERSITY AFFILIATION: University Relationship: ☐ Faculty ☐ Staff
CAMPUS ADDRESS: Bldg/Room: ECG 343 Mail Code: 6106	PHONE: 480-965-4979	☒ Graduate Student ☐ Undergraduate Student ☐ Other. Please specify.
	E-MAIL: Lynn.Cozort@asu.edu	
CO-INVESTIGATOR:	DEPARTMENT/CENTER:	UNIVERSITY AFFILIATION: University Relationship: ☐ Faculty ☐ Staff
CAMPUS ADDRESS:	PHONE:	☐ Graduate Student ☐ Undergraduate Student ☐ Other. Please specify.
	E-MAIL:	

OTHER IRB REVIEW

1. Has this project been reviewed by another IRB? __Yes _X No_ (If yes, please complete the information below and attach a copy of the IRB approval materials).
a) What is the name of the institution?

b) What is the current IRB approval date/status of IRB application?

Social Behavioral IRB Application Form – Page 1
Revised July 2006

2. Provide a brief description of the background, purpose, and design of your research. Avoid using technical terms and jargon. Be sure to list and include all of the means you will use to collect data (e.g. instruments, measures, tests, questionnaires, surveys, interview schedules, focus group questions, observations). Provide a short description of the tests, instruments, or measures and attach copies of all instruments and questionnaires for review. (If you need more than a few paragraphs, please attach additional sheets.) FOR ALL OF THE QUESTIONS, WRITE YOUR ANSWERS ON THE APPLICATION RATHER THAN JUST SAYING SEE ATTACHED.

Background:

There is a major concern for the future of engineering -- claims are made that a great number of currently employed engineers are baby boomers getting ready to retire and that there will not be enough domestic engineers to replace them. "Every two years the National Science Board supervises the collection of a very broad set of data trends in science and technology in the United States, which it publishes as *Science and Engineering Indicators*. In preparing *Indicators* 2004, the NSB said, 'We have observed a troubling decline in the number of U.S. citizens who are training to become scientists and engineers, whereas the number of jobs requiring science and engineering (S&E) training continues to grow.'"(Friedman 2006). "The same kind of talk that was used by the panel famed for *A Nation at Risk* is now being employed by business leaders, scientists, pundits, and public officials from President Bush on down to spur initiatives aimed at ensuring that the nation's pipeline of scientists, engineers, and mathematicians does not run dry." (Viadero 2006) The executive director of the National Science Teachers Association said he "personally feel[s] that (the prediction of an inadequate supply of scientists and engineers) is correct, because this time the concern is coming from corporate America saying they are actually experiencing the problem." (Viadero 2006) The numbers of engineering students internationally compared to US students is debatable and scrutinized. "The effect of the dynamics of engineering outsourcing on the global economy is a discussion of keen interest in both business and public circles. Varying, inconsistent reporting of problematic engineering graduation data has been used to fuel fears that America is losing its technological edge."(Gereffi and Wadhwa 2005) "India is now in the throes of a higher education revolution, and its colleges are churning out thousands of professionals each year. Despite the fact that 35 percent of its population still cannot read or write, the country has successfully positioned itself as one of the world's foremost producers of math, science, and technology graduates, forcing current leaders in the field – including the United States – to take a closer look." (Honawar 2006) A student cannot just decide to become an engineer and attend a technical school for a couple of years. Given our current education system, students must make a decision to become an engineer in middle school so that they will be able to gain the foundational math and science required to enter a college engineering program. "It takes fifteen years to train a scientist or advanced engineer, starting from when that young man or woman first gets hooked on science and math in elementary school." (Friedman 2006). Although, there are claims that the reports from India and China include students from three-year degree programs as well as diploma holders which bolsters the number of engineering graduates.(Gereffi and Wadhwa 2005)

Another concern raised is that future jobs are being affected by technology because anything that can be digitized can, is, and most likely will be, outsourced and the primary threat is the amount of outsourcing to India and China. Industry is looking and planning for "knowledge jobs" and it is questionable whether we are preparing students for those types of jobs. "Having reviewed trends in the United States and abroad, the committee is deeply concerned that the scientific and technological building blocks critical to our economic leadership are eroding at a time when many other nations are gathering strength." (Academies 2006) "In a developing country like India, the emphasis is on 'developing.' And certainly, India is developing like an overzealous bodybuilder on a steady diet of steroids." (Grose 2006) "The realization that many engineering tasks are being farmed out to China and India, both of which have dramatically larger numbers of engineering graduates, has served to heighten concern about retention." (Dym 2006) "The most sought-after labor commodity is no longer a muscular hand that can crank a wrench, but a pumped-up brain that can think creatively, critically, and out-of-the-box." (LeGault 2006) "The challenge for the United States over the next decade will be to retain its role as a global pacesetter in the education of engineering and scientific talent and thereby to sustain its legacy as a preeminent technological innovator." (Gereffi and Wadhwa 2005) These growing concerns have focused attention on incorporating engineering outreach programs into the K-12 education system. "Recently, the American Society for Engineering Education (ASEE) has embarked on an ambitious effort to promote and improve K-12 engineering and engineering technology education." (Reid and Feldhaus 2005) "The NSF continuously calls for STEM [Science, Technology, Engineering and Mathematics] integration in its education and integration grants." (Wicklein 2006) There are University engineering programs being implemented in the K-12 system. For example, in Massachusetts the school board has adopted an engineering

program that will count as one of the four options for science and in 2008 engineering will count as one of the accepted science tests required for high school graduation. (Daniel 2006) Secretary of Education Margaret Spellings, Senator Michael B. Enzi, Senator Johnny Isakson and Senator Lamar Alexander traveled to India in April 2006 to examine how their schools produce "top-notch" engineers and technology professionals. "The congressional trip to India was intended to help inform those efforts, which are included in the competitiveness initiative the administration is pushing. 'We need to learn all we can about the successes of our world neighbors and how we can benefit,' Sen. Enzi said in a statement before he left." (Kein 2006)

Purpose:

The purpose of this research is to learn about the cultural and educational experiences of Indian engineering students. Other universities have conducted quantitative studies regarding engineering outreach programs into the K-12 educational system, studies to examine the statistics associated with engineering students, and reports on women and minorities in engineering. However, it does not appear that anyone has conducted a qualitative study to investigate the cultural and educational backgrounds of Indian engineering students. The growing concerns regarding India as a major competitor for engineering education and engineering jobs cannot be adequately addressed without complementary qualitative studies to complete the picture and have a better understanding of who are "competitors" will be. In addition, as LeGault points out "Americans need to learn more about the history and culture of other peoples and countries, not to 'celebrate' diversity, but to specifically understand how and why the world works." (LeGault 2006)

Design:

Thirty four men and three women who are citizens of India and currently enrolled in graduate degree programs at Arizona State University in Mechanical and Aerospace Engineering (a department chosen because of convenience, Lynn Cozort is employed by that department, and because it is the only engineering program consisting of two separate majors which will help broaden the scope of the study) will be sent a recruitment letter asking for volunteers to participate in this study. The participants will meet with Lynn for several hours to discuss their homes, their cultural backgrounds and their educational experiences. For the convenience of the participants and the researcher, the interviews will be held on Saturdays and Sundays on campus in the Engineering Center G-Wing. The interviews will be informal so that a rapport is established and the participants will be able to freely discuss their backgrounds without the confinement of a formalized questionnaire. However, the researcher will take care to guide the discussion to encompass questions regarding the participants' home town (location, and demographic information, etc.), their families (for example, number of siblings, employment of parents, etc.) and their education (describe their school system, classrooms, expectations of teachers, parents, themselves, when and why they became interested in engineering, etc.). The interviews will be videotaped and audiotaped, a fact that is disclosed to the participants in both the recruitment letter and the consent form. With a large number of interviews, data analysis will be time intensive; it will take several months to transcribe the interview sessions and time tends to diminish memories of the nuances that occurred during the interview. Videotapes will facilitate in accurately portraying the individual interviewees without the distraction of the researcher trying to take notes during the interview . The researcher will code the data and protect the identities of the participants using pseudo-names, or referred to as participant A, participant B, etc.

References:

National Academies. (2006). Rising Above the Gathering Storm, National Academy of Sciences, National Academy of Engineering and Institute of Medicine: 1-15.

Daniel, A. (2006). "A Powerful Force." ASEE Prism 15(5): 26-29.

Dym, C. L. (2006). "The Terrible Two's." ASEE Prism 7(15): 64.

Friedman, T. L. (2006). The World Is Flat. New York, Farrar, Straus and Girous.

Gereffi, G. and V. Wadhwa (2005). Framing the Engineering Outsourcing Debate: Placing the United States on a Level Playing Field with China and India, Duke University: 1-11.

Grose, T. K. (2006). "A Surprising Shortage." ASEE Prism 15(6): 24-27.

Honawar, V. (2006). "Ticket To Rise." *Teacher Magazine* 17(5): 1046-6193.

Kein, A. (2006). "Spellings Joins Passage to India On Education." *Education Week* 25(32): 26.

LeGault, M. R. (2006). *Th!nk*. New York, Threshold Editions.

Reid, K. and C. Feldhaus (2005). "Articulation Agreements With High Schools Implementing Project Lead The Way (PLTW)." *Proceedings of the 2005 American Society for Engineering Education Annual Conference & Exposition*.

Viadero, D. (2006). "Talk of U.S. Crisis in Math, Science Is Largely Misplaced, Skeptics Say." *Education Week* 25(28): 21.

Wicklein, R. C. (2006). "Five Good Reasons for Engineering Design as the Focus for Technology Education." *The Technology Teacher* 65(7): 25-29.

STUDY DURATION

3. What is the expected duration of the study through data analysis? (Include a timeline, if applicable).

3-6 months for data collection; 18 months to transcribe, code and analyze the data.

a. When is the expected date that you wish to begin research? (MM/DD/YY) _10/_14/_06_(must be after submission date)
Note: Protocols are approved for a maximum of 1 year. If a project is intended to last beyond the approval period, continuing review and reapproval are necessary. Research cannot begin under you have received an approval letter.

PROJECT FUNDING

4. How is the research project funded? (A copy of the grant application(s) must be provided prior to IRB approval)
_X_Research is **not funded** (Go to question 5)
__Research is **funded**
__**Funding decision is pending** (funding decision has not been made)

a) What is the title of grant or funding application?

b) What is the source of funding or potential funding? (Check all that apply)
_____ Federal   _____ Private Foundation   _____ Department Funds
_____ Subcontract   _____ Fellowship   _____ Other _____

c) What is the grant number and ASU proposal number?
d) Identify the institution(s) administering the grant(s):

STUDY SITES

5. Where will the study be conducted? (Check all that apply)
_X_On campus (Please indicate building(s) and room number (s) when known)

Engineering Center, G-Wing rooms 343 and/or 346

__Off campus (Please provide location and letter of permission from institution, where applicable)

6. What is the **MAXIMUM** number of subjects that you plan to enroll in the study?

a) What is the approximate number of: 34 Males   3 Females

b) Indicate the age range of the participants that you plan to enroll in your study.   23 to 30

c) What is the expected duration of participation for each subject? (at each session and total)

3-5 hours at first interview session; 1-2 hours for possible follow-up interviews; 7 hours total

7. Will the study involve any of the following participants? (Please check all that apply if your study specifically targets these populations)

____ Children (under 18)   ____ Pregnant women
____ Prisoners or detainees   ____ Persons at high risk of becoming detained or imprisoned
____ Decisionally impaired   ____ Patients- what is the status of their health?_____
____ Fetuses   ____ Native Americans (provide copy of tribal approval)
____ Non-English speakers (Include copy of all materials in language of participants and certification of the translation and back-translation: http://researchadmin.asu.edu/compliance/irb/apply/backtranslation-form.doc)

a) If **any** of the above categories have been checked, please state how you will protect the rights and privacy of these individuals. N/A

b) Please provide the rationale for the choice of the subjects including any inclusion and exclusion criteria.

Convenience – these subjects are all current graduate students enrolled at Arizona State University in the Mechanical and Aerospace Engineering Department (MAE). All of the MAE graduate students who are citizens of India will be given an opportunity to volunteer for the study. There are no inclusion or exclusion criteria.

8. Describe the process you will use to **recruit participants** and inform them about their role in the study. (Attach copies of any recruitment materials.)

The attached recruitment letter will be sent via e-mail to all engineering graduate students enrolled in degree programs at ASU in the Mechanical & Aerospace Engineering Department whose citizenship designation is India.

a) Will any of the following be used? (Check all that apply and attach copies)
 X Internet/Email
____Newspapers/radio/television advertising
____Posters/brochures/letters
____Other_____

Social Behavioral IRB Application Form – Page 5
Revised July 2006

DECEPTION

9. Does the proposed research require that you deceive participants in any way?   __Yes __X_No

a) If your response is "yes," describe the type of **deception** you will use, indicate why it is necessary for this study, and provide a copy of the debriefing script.

COMPENSATION

10. Will any type of compensation be used? (e.g. money, gift, raffle, extra credit, etc)
__Yes   X No (If yes, please describe)

INFORMED CONSENT

11. Describe the procedures you will use to obtain and document **informed consent and assent. Attach copies of the forms that you will use.** In the case of secondary data, please attach original informed consent or describe below why it has not been included. Fully justify any request for a waiver of written consent or parental consent for minors. (The ASU IRB website has additional information and sample consent and assent forms.)

The recruitment letter indicates that if an individual wishes to participate in this study they need to contact Lynn Cozort. Once they have indicated they would like to participate, they will be e-mailed the attached Consent Form to complete and asked to return it in person, with their original signature. Lynn Cozort will keep the signed Consent Forms in a locked file cabinet in ECG 343.

RISKS

12. What are the potential risks of the research? (Check all that apply)
____ physical harm
____ psychological harm
____ release of confidential information
____ other

a) Describe any potential risks to human subjects and the steps that will be taken to reduce the risks. Include any risks to the subject's well-being, privacy, emotions, employability, criminal, and legal status. None

BENEFITS

13. What are the potential benefits to the individual subject, if any, as a result of being in the study?

The participants will have an opportunity to share their backgrounds and personal stories, fostering a sense of inclusion and an understanding that their cultural heritage is valued.

a. What are the potential benefits, if any, to others from the study?
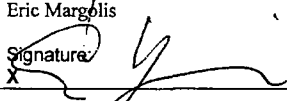
The information generated from this study could serve to engage more domestic students into an engineering curriculum and improve math, science and technology education.

Social Behavioral IRB Application Form — Page 6
Revised July 2006

DATA USE
14. How will the data be used? (Check all that apply) ☒ Dissertation ☒ Publication/journal article ☐ Thesis ☐ Undergraduate honors project ☐ Results released to participants/parents ☐ Results released to employer or school ☐ Results released to agency or organization ☐ Conferences/presentations ☐ Other *(please describe):*

PROTECTION OF CONFIDENTIALITY
15. Describe the steps you will take to ensure the confidentiality of the participants and data. Indicate how you will safeguard data that includes identifying or potentially identifying information (e.g. coding). Indicate when identifiers will be separated or removed from the data. a) Where on campus will you store the data and media and ensure its security (videotapes and/or audiotapes)? The videotapes will be stored in a locked file cabinet at Lynn Cozort's home. The audiotapes will be downloaded on Lynn's personal computer at home for transcription purposes. No data will be stored on ASU's campuses. b) How long do you plan to retain the data? The videotapes will be retained permanently. The audiotapes will be retained for 5 years. c) How will you dispose of the data? The videotapes will not be destroyed. The audiotapes will be erased immediately after being downloaded onto Lynn's computer. At the end of 5 years, the data from the audiotapes will be permanently deleted from Lynn's computer.

INVESTIGATOR INTERESTS
16. Do any of the researchers or their family members, have a financial interest in a business which owns a technology to be studied and/or is sponsoring the research? ___ Yes _X_ No (If yes, please describe and disclose in the consent form) a) Does the investigator have a current conflict of interest disclosure form on file at the ASU Research Compliance Office? _X_ Yes ___ No b) Are there any plans for commercial development related to the findings of this study? ___ Yes (If yes, please describe.) _X_ No c) Will the investigator or a member of the investigator's family financially benefit if the findings are commercialized? ___ Yes (If yes, please describe.) _X_ No d) Will participants financially benefit if the findings are commercialized? ___ Yes (If yes, please describe.) _X_ No

TRAINING
17. The research team must document completion of human subjects training. (Attach a copy of the NIH Certificate for Human Participants Protections Education for Research Teams or CITI Training: http://researchadmin.asu.edu/compliance/irb/training/ for the PI and Co-Investigators.)

Social Behavioral IRB Application Form — Page 7
Revised July 2006

PRINCIPAL INVESTIGATOR

In making this application, I certify that I have read and understand the <u>ASU Procedures for the Review of Human Subjects Research</u> and that I intend to comply with the letter and spirit of the University Policy. Changes in the protocol will be submitted to the IRB for written approval prior to these changes being put into practice. **I also agree and understand that informed consent/assent records of the participants will be kept for at least three (3) years after the completion of the research.**

Attach a copy of the PI's CV unless one is already on file with the Research Compliance Office.

Name (first, middle initial, last):
Eric Margolis

Signature:
X

Date: 9/27/06

DEPARTMENT CHAIR

Name (first, middle initial, last):

Signature: Date:
X

(If the PI is the Department Chair, the application must be signed by another authorized Department/ School/College level Administrator.)

FOR OFFICE USE:	This application has been reviewed by the Arizona State University IRB:
	☐ Full Board Review ☐ Expedite Categories:_____ ☐ Exempt Categories: _____ ☐ Approved ☐ Deferred ☐ Disapproved ☐Project requires review more often than annual Every _____ months
	Signature of IRB Chair: Date: X

Social Behavioral IRB Application Form – Page 8
Revised July 2006