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THE MULTISKILLED HEALTH PRACTITIONER:
EDUCATIONAL PREPAREDNESS AND EFFECTS OF TECHNOLOGY ON
ORGANIZATIONAL WORK PRACTICES IN HOSPITAL SETTINGS

by

Renee Fayhe Tossell

A Dissertation Submitted to the Faculty of the
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2000
As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Renee F. Tossell entitled The Multiskilled Health Practitioner: Educational Preparedness and the effects of Technology on Organizational Work Practices and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

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Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

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ABSTRACT

THE MULTISKILLED HEALTH PRACTITIONER:
EDUCATIONAL PREPAREDNESS AND THE EFFECTS OF TECHNOLOGY ON ORGANIZATIONAL WORK PRACTICES IN HOSPITAL SETTINGS

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This paper investigates the multiskilled health practitioner (i.e., imaging specialist) how they are trained for what they do and the way their traditional role as a generalist in radiologic technology has been impacted by advancing technologies. This dissertation consists of multiple case studies, which is primarily qualitative and exploratory in nature. It does not test a hypothesis in a strict sense and is grounded in analytical categories and theories derived from the literature on technology, work, occupations, and organizations. The data analysis section consists of four sections: perceptions of the MSHPs’ work, the impact of technology (i.e., incentive structures, wages, issues of autonomy/authority, task difficulty/responsibility and patterns of interaction), the enskilling/deskilling findings for all MSHPs in general and each hospital subgroup, and the MSHPs perceptions about the effectiveness of their formal education programs. With regards to a cultural examination of the workplace, the most significant sociological perspective identified were in the patterns of interaction. Specifically, three primary stylistic differences are noted. In
relation to the effects of technology, an institutionalized practice of the incentive structure and the homogeneity of three broad skills were noted among our cohort. Additionally, three contextual factors that condition social action and thereby affect a technology's tendency to enskill or deskill are revealed. In light of the attributes and deficiencies noted by the interviewees regarding their formal educational programs and skills required for their new roles, the researcher provides five recommendations for strengthening technology transfer programs in which to better prepare the MSHP.
CHAPTER I: INTRODUCTION

The health care industry is a social institution in transition. Many of the changes occurring in the health care industry are reactions to environmental changes, complex technologies, the provision of services, the proliferation of HMO's, and government intervention in health care delivery (Baker, 1986; Raffel, 1984; Hatch, 1986). These changes are affecting the labor force by shifting the familiar patterns of the nature of work as well as the values and expectations of those who work. In the late nineteenth century, Karl Marx theorized the relation of the effect of work on the individual in terms of alienation. Max Weber theorized it in terms of the "iron cage" that bureaucracy imposed on individual freedom. Both emphasized that industrial work in capitalist economies is doing damage to the minds and spirits of workers. Specifically, they and others believe that the more autonomous and self-directed a person's work, the more positive its effects on personality; and the more routinized and closely supervised the work, the more negative its effects (Erickson & Vallas, 1990; Kohn, 1982). Throughout the twentieth century, scholars have shown this to be true for both men and women and for workers in socialist as well as capitalist industrial economies.

Technology has also had a profound influence on the structure of the workplace and employees in the health care industry. Technology influences social structure by molding modes and social relations of production. In a broad sense, one of the seminal works on this subject is Daniel Bell's "The Coming of Post Industrial Society" (Bell, 1973). "The changeover to a post industrial society is significant not only by the change in a distinct part of society but in patterns of occupations, the kind of work people do" (Bell
1973:134). Furthermore, "A post industrial society is a game between persons. What counts is not raw muscle power, or energy, but information. The central person is the professional [and specifically for purposes of this research study the multiskilled radiologic technologist], for he/she is equipped by his education and training, to provide the kinds of skill which are increasingly demanded" (Bell, 1973:127). The central feature of the transformation to the post industrial society, in Bell's words, is "a changeover from a goods-producing society to an information or knowledge society" (Bell 1973:147).

This is certainly the case with the high technology industry of health care delivery whereby various types of information processing, such as computers and telecommunications, and the manufacture of highly complex equipment to aid in diagnosis and treatment, have changed the structure of labor in the medical community. Not only has the new technology produced more knowledge about diseases and provided more sophisticated methodology for the health practitioner, but it has changed health care by impacting the manpower needs of the industry. For example, some skills that were routinely performed by the health care labor force are now obsolete, as they are more efficiently performed by the new technology. However, at the same time, new skills are needed to operate the technology giving way to the epigenesis of a new class of health care workers the multiskilled health practitioner. The technology and the need for training and retraining of health personnel to operate the technology have not only altered the way health care is delivered but the roles and responsibilities of health care employees (Jaffe, Oglesby, & Drewes; 1982).
Stephen Barley's 1986 analysis of the effects of CT scanners in Radiology departments, "Technology as an Occasion for Restructuring", examined several concepts and variables that are central in organizational theory: size, merit, structural differentiation (vertical and horizontal), productivity, and incentive structure. His work reaffirmed the process of structuration: technologies change organizational and occupational structures by transforming human actions which, in turn, alter the institutional structure, roles, and pattern of interaction.

Additionally, two influential theories about technology and work are synthesized and modified in Steven Vallas' (1990) work. Vallas developed and administered two cross sectional surveys that explored the link among new technologies, the organization of the labor process, and workers' attitudes toward both their jobs and their employers. When technologies are introduced into craft and clerical work, how are the existing levels and forms of working knowledge challenged? Do companies invoke new and ever-more sophisticated technologies partly to reduce their dependence on their employees, uprooting workers' skills and deepening management control over the work process? Or do new technologies relax the constraints imposed on human labor, promoting more innovative and participative models of workplace relations creating a new division of labor founded on commitment, responsibility, and social integration?

Technological change has impacted various aspects of employees' lives, including wage structures. Increasingly there is a pattern of pay for jobs mastered (Lawler, 1977; Tosi and Tosi, 1986). For instance, an analysis by Galor & Tsiddon (1995) demonstrated that the interplay between technological progress and two components that determined
individual earnings parental specific human capital and individual ability governed the evolution of wage inequality, intergenerational earnings mobility, the pace of technological progress and economic growth. The paper rests on several observations that are largely supported by empirical evidence: (a) individual earnings increase with ability; (b) individual earnings increase with parental human capital the closer parental and offspring's sectors of employment, the stronger the parental effect; (c) major technological progress (i.e., inventions) increase the relative return to ability and thus diminish the relative return to parental specific human capital; (d) improved accessibility of technologies (i.e., innovations) decrease the relative return to ability, while enhancing the relative return to parental specific human capital; and (e) technological progress (or the rate of adoption of new technologies) is positively related to the average level of human capital in technologically advanced sectors.

The above changes, including with regard to pay, hold true for the multiskilled health care worker, operationally defined (for the purposes of this research proposal) as a health care professional who provides primary services in one department but can function in a variety of hospital settings and exercise a wide range of skills (NCAHE 1984: 153). The Advisory Panel of the National Multiskilled Health Practitioner (MSHP) Clearinghouse defined the MSHP as workers cross trained to provide more than one function, often in more than one discipline. These combined functions can be found in a broad spectrum of health related jobs ranging in complexity from the nonprofessional to the professional level, including both clerical and management functions. The additional functions added to the original health care worker's job may be of higher, lower, or parallel level (Fotler,
1992). For example, the radiologic technologist performing nuclear medicine scans may be considered higher level skills, whereas, the registered nurse asked to monitor vitals and calculate drug doses in another department may be considered parallel skills since these tasks are routinely performed in his/her own area. Multiskilling is a term used frequently in health care literature of the 1990’s. In the present context, it has been used to denote the use of regulated health care workers to perform functions outside their usual scope of practice and within those of other disciplines (Austad, 1995).

It seems that the pay for skill system appears to run counter to the outcomes that many neo-Marxist critics attribute to modern corporations: the deskilling of jobs so as to confine and reduce employees to lower pay levels, partly to make it easier to accommodate turnover, ensuring that a reasonable proportion of the workforce is always new and thus always paid at the lowest rates (Braverman, 1974). There are instances of deskilling of craft labor in the 20th century (Attewell, 1987). Additionally, studies have documented the effects of Fordism, which involves rigid job specialization, mass production, machinery, standardized products, and vertical integration. Fordism largely turns workers into appendages of machines (Doray, 1988). Although scholars are now speaking of a post-Fordist society, hospitals are seeking Ford’s model as a way to increase cost containment. When the Department of Labor committed itself to the high performance workplace model, the strategies of cross-training, restructuring, and the use of multiskilled workers, it understood that these techniques had been used in manufacturing settings where tasks are routine (ANA, 1994). The problem is that the
model had never been tested in health care organizations, where the product is patient care. The issue has also been little studied in that context.

As technical occupations are now touted as the fastest growing segment of the U.S. economy (Barley 1991), employers and policy makers continue to wrestle with three primary questions: What is the nature of skill in technical work and technical occupations? What are the skills that technical workers must possess in order to perform their jobs? and most importantly, Where and how do technical workers acquire their skills? (Scarselletta, 1993).

Employers and policy makers involved in the technical arena have readily assumed that technical skills follow from formal education. Therefore, labor market problems that they have encountered in technical occupations such as skill shortages and low productivity have been believed to be the result of problems of insufficient technical education. It is not surprising that they call for educational reform as the primary means of remedying problems related to skill in the technical workforce (Bishop and Carter, 1991). This is another issue that is relatively unexplored in the context of health care industry technical workers.

What is skill? The meaning varies by the context of its use (More, 1982; Wood, 1982). When applied to individuals, the term usually denotes knowledge or ability, both of which are more or less enduring attributes of persons. But, skill may also refer to the requirements of a job, in which case it is best construed as a property of the task rather than of the individual. When applied to occupations, however, skill often connotes prestige or social status, which may be only loosely tied to either a practitioner's abilities
or the tasks they perform. Finally, in some situations, skill may be a little more than a label devised to set one group apart from another (Turner, 1962). These semantic ambiguities can undermine investigations of technical change, if the analyst fails to distinguish carefully between the term's various referents.

Credentials, including college diplomas, are just one indicator of skill. They are a primary mechanism by which individuals signal to employers their potential to perform competently with a given task. However, exclusive focus on education as a gauge for measuring skill is misleading. Skill is not simply knowledge but also "the ability to do something well" (Attewell 1990; Vallas 1990).

The measurement of skill has proven problematic for researchers. Since it is impossible to "observe" skill directly, researchers have tended to rely on proxy measures from which they infer the existence and exercise of skill. This is particularly true in the case of job related skill, which is most applicable to the MSHP. A common metric used in survey research to assess an employee's skill on the job has been education (Becker 1975; Field 1980). The logic behind utilizing education to measure skill is that education imparts job-relevant knowledge. The more educated an employee, the more job relevant knowledge, and hence the more "skill" they are said to possess. An alternative to the education centered measure of skill has been the use of output measures such as productivity and the quality of the product. The assumption here is that skill translates to performance: the more skilled a person is, the more productive they are and the higher quality product.
The obfuscation of the concept of skill through the use of proxy variables has had serious policy implications. Too often, policy makers and employers cry for more education and more training without understanding the actual meaning of skill in the context of a given technical occupation. Therefore, they run the risk of simply requiring more of an education that is not aligned with the actual requirements of the job. As Randall Collins (1979) demonstrated, the link between formal education and skill in many occupations is at best tenuous. If there is a disjunction between the meaning and measurement of skill, then initiatives predicated solely on education and training could lead policy makers to implement solutions which, ironically, exacerbate the very problems they seek to solve.

There is a disjunction between the meaning and measurement of skill. Education and training do not equal skill. Similarly, even productivity and quality indexes may not capture skill. There is a danger that in equating skill with surrogate variables, researchers divorce the concept from work practice, what is it that people actually do on the job, and hence obscure the meaning of the concept. Skill resides not in the inputs or outputs of a labor process but in the process itself. Inevitably, skill resides in a performance.

Therefore, a remedy to these epistemological and pragmatic shortcomings can only be found in the study of work practice, that point in the labor process where skill is actually articulated. Exclusive focus on the metrics of skill in technical occupations has diverted researchers' attention away from the actual practices and processes by which technical work is accomplished. We simply know very little about what technical workers do on a day-to-day basis. The study of work practice offers more than simply a means of
understanding what technicians do. A practice-based view of skill serves to bridge the gap between exogenous and endogenous labor process variables by assessing firsthand the articulation between education (what technologists learn in school), skill (the competencies that their work actually requires) and quality (the end products of a technical labor process).

Statement of the Problem

The problem addressed in this investigation is twofold: First, to explore what effects technology has had on the multiskilled health practitioner's organizational work practices including incentive structures, wages, autonomy, and skill development. Second, to investigate how the formal educational program of the MSHP adequately prepared them for a changing workplace environment. For the purposes of this research the MSHPs who I have studied are radiologic technologists who function primarily in diagnostic radiology but who have been asked to perform duties in any of the following areas or combination thereof: Nuclear Medicine (NM), Computerized Tomography (CT), Magnetic Resonance Imaging (MRI), Cardiovascular Interventional suites (CVIT), Mammography (M), and Ultrasound. This investigation of the nature of the MSHP's work will include a cultural examination structured around the first research question: From a sociological perspective, what conceptions do the multiskilled health care worker hold about their work and the organization in which it is performed, including beliefs about their co-workers including the Radiologist?

With regards to the effects of technology, this study will examine how organizational work practices within specific health care institutions have changed by examining the
MSHP in regards to incentive structure, wage, issues of authority/autonomy/task difficulty, and patterns of interaction. The effects of technology upon the multiskilled health care worker will be structured around the second research question: How has the impact of technology affected the multiskilled health practitioner's organizational work practices prior to and following the implementation of their new tasks needed to meet technological demands, and how does their new position fit with regards to incentive structures, wages, issues of authority/autonomy/task difficulty, and patterns of interaction?

What evidence can be found that best reflects the situation of the multiskilled health practitioner in terms of the enskilling/deskilling debate, structured around the third research question: Within their health care setting, have the new technologies reduced dependence on employees, uprooting workers' skills and deepening management control over the work process (deskilling) or has workplace automation relaxed the constraints imposed on human labor creating a new division of labor founded on commitment, responsibility, and social integration that promotes more innovative and participative models of workplace relations (enskilling).

Finally, the fourth research question will center around an educational and pragmatic inquiry: What ways did the formal education of the MSHP adequately prepare them for a changing workplace environment?

**Purpose/Significance of the Study**

The purpose and significance of this study will be to investigate and explore the experience of the MSHP radiologic technologist. Although Radiologic Technology is a
discipline that originated at the turn of the century, little is known about how this
discipline has grappled with the transformation of work occasioned by the Second
Industrial Revolution. During the 1950's, when organizational theory became a
recognized discipline, most scholars grounded their theories in investigations of work
processes (Blauner, 1964; Chinoy, 1955; Gouldner, 1954). In recent years, however,
organizational and managerial theorists have become increasingly estranged from the
study of work, gravitating to perspectives that emphasize the dynamics of markets and
populations, or managerial cognitions. Even in studies of production systems, work and
workers rarely appear (Barley, 1990). As a result, organizational and managerial theory is
conspicuously silent on the topic of how people are trained for what they do and how they
do it. Moreover, most deskilling theorists have ignored recently created technical
occupations under the presumption that technical and managerial workers share similar
world views (Attewell, 1987). Not only is such a presumption suspect (Pettigrew 1973;
Wilkins 1983; Van Maanen and Barley 1984), but by failing to examine such
occupations, deskilling theorists avoid testing whether their thesis is, in fact, a "general
tendency of capitalism" or whether it merely describes the fate of specific occupations in
a changing socioeconomic system. To assess deskilling theory's scope, researchers must
examine shifts in the occupational demography of the labor pool as well as histories of
selected occupations. In practical terms, organizations are nothing more than systems for
coordinating work. Changes in the nature of work are likely to be a significant source of
organizational change. A good start would be a study that investigates technical jobs and
how work is affected by the introduction of advanced technologies.
Failure to investigate these parameters may leave organizational studies as a discipline unable to grapple with the very type of social transformation that provided its original raison d'être. If scholars dismiss studying work, organizational and managerial theorists may promote theories that describe shifts in organizing without coming to terms with their causes. To do that would be to risk grounding our thinking as well as our policies on the shoals of spurious correlation's.

When one speaks of the sociology of work, it is inevitable that the classic theme of the discussion will be that of the effect of the work on the person. Since the middle of the century, sociological research has centered on patterns of communication and identity that workers have forged while at work (Chinoy, 1955; Garson, 1977). However, methodological and theoretical developments have shifted the attention of sociologists away from workplace culture and towards the formation of communities and identity (Barley, 1988). Although workplace surveys have provided important findings about work attitude among managers and union members, the literature does not speak about the patterns of interaction between individuals and the wider cultural environment. In so doing, this study will attempt to "breach the wall of demarcation" (McCloskey, 1986) and to "blur genres" as Clifford Geertz (1984) has suggested. An identification of the culture of work will allow an exploration of the beliefs that people hold about their jobs in the organizations in which it is performed and the beliefs about the kinds of people suited to work with them. This perspective reminds us that jobs have rational myths: mystiques, auras and stigmas that go beyond the content of tasks. Comparatively, an examination of the wider culture may reveal the cultural beliefs that assign value to the way work is
organized or stratified: by gender, by group, in a circle or on a line. The wider culture can establish rules that specify how people ought to think and act about their work, and about themselves. It encourages some groups to aspire to certain jobs, while requiring other groups to accept others. This is certainly descriptive of the environs for the multiskilled health care worker. To tear the workplace out of the cultural milieu that gives it life is to substitute simplistic models for the complex richness of human life.

When we look at why the multiskilled health care worker has been recruited with regards to increasing institutional productivity, much of the discussion has centered on cost containment.

In an article in the *Hospital Manager* (AMA, 1986), William Culbertson was quoted as supporting "cross training" as a method to control costs. Culbertson emphasizes that although the preparation of these new technicians might follow various paths, "the person who can do more than one job is more valuable than the person qualified for only one assignment" (p.9). Furthermore, he states that in order to keep employees productive, they may sometimes need to be assigned to functions which they are capable of doing but for which they were not originally trained.

George Speese, consultant for the Human Resources Development Corporation, has conducted numerous workshops on the most effective methods for increasing productivity through better utilization of personnel. Speese has encouraged hospital employers to cross utilize personnel to increase productivity. When comparing the health care industry with other businesses, he makes the point that General Motors returned to the "generalist" in their new plant concept to increase productivity by re-establishing their
right to assign anyone, anyplace at anytime. He contends that hospital administrators must adopt this concept if they are to provide cost effective quality care (Speese, 1981).

Sociologists of technology have often been stymied by technology's dual status as a physical object (the drone of the machine) and a social object (the cultural environment). The duality has lured theorists down one of two ostensibly different paths: the sociology of automation or deskilling theory. A number of authors, particularly Stephen Barley and Steven Vallas, have searched for alternative theoretical explanations that go beyond the dichotomous enskilling/deskilling debate.

Stephen Barley (1988) argues that those traditional approaches to the study of technology and work (the sociology of automation) and deskilling theory are usually portrayed as antithetical. Each is equally deterministic in its orientation and therefore incapable of handling the social complexity and equivocality of technical change. Barley recommends the concept of "interpretive materialism" as an approach that can fuse technology's materialism and work's idealism. Specifically, interpretive materialism holds that technologies should be studied as social objects and that the dynamics of power are more relevant than the dynamics of skill. Whether a technology will degrade or enhance work is a function of the technology's attributes, the characteristics of its organization and occupational milieu, and the socioeconomic environment.

According to Vallas (1988), Marxist theory has long argued that the development of capitalism tends to proletarianize employees. In line with predictions of deskilling, computerization seems to heighten managerial control over worker's jobs, lower the conceptual content of worker's tasks, and increase alienation. While mainstream theories
predict that new technologies will upgrade work content, recent Marxist analyses argue that workplace automation tends to deepen the subordination of the worker beneath the means of production. In Vallas' study, an attempt is made to test between these rival perspectives through an analysis of the US communications industry, a highly automated "knowledge" industry rapidly undergoing the transition to competitive market conditions. Even though his findings support an upgrading effect between 1950-1980, recent analysis suggests a deskilling trend. The more automated the workplace, the less autonomous and conceptually demanding the job tends to be. His analysis also suggests that workplace automation differentially affects various occupational categories and additionally that even when workers are enskilled in some ways they are also subjected to greater managerial control.

Additionally, the majority of researchers are not as sanguine about the impact of new technologies on the skills required by workers and the ability of educational institutions to meet those increasing needs. Community colleges consistently view themselves as capable of meeting business and industries demand for technology transfer with committed and capable leadership. Certainly this has been the case for the certified radiologic technologist (generalist). However, does the same hold true for the MSHP imaging technologist (specialist)? The literature is devoid of an answer to this question for this particular group of health care workers.

With regards to new technologies (i.e., imaging modalities), this study will look at the concept of skill among the multiskilled health practitioner (i.e., radiologic technologist), its relationship to educational preparedness and provide evidence for the
enskilling/deskilling relationship between manager and worker as well as the worker themselves.
CHAPTER II: REVIEW OF THE LITERATURE

The review of the literature for this study on multiskilled health practitioners will be presented in four sections. These sections will include: 1) an overview of the nature of work which includes a cultural examination of the workplace; 2) the effects of technology on organizational work practices; 3) a discussion of the enskilling/deskilling debate; and 4) workforce training at the post-secondary educational level.

Section I: Culture in the Workplace

Because technologies almost always enter work settings with a past, most become rapidly embedded in a cultural and historical context that influences their use. For this reason, within the limits set by their physical properties, technologies are also molded into social objects by what Van Maanen (1984) terms an organization's tendency to "do new things in old ways". Over time, members of the organizations develop behavioral scripts and interpretive schemes that enable them to construct and maintain predictable environments. Schemes and scripts act as templates that hone the rough edges off reality to yield a more familiar and comfortable definition of the situation (Weick 1979).

Cultural templates are likely to vary from organization to organization, and it would seem likely that worker subcultures are as capable as managerial subcultures of shaping a technology's use. Although never systematically studied, incidental evidence points to the importance of this "cultural shaping" in the construction of technical orders.

For example, in a longitudinal study of technical change in two radiology departments, Barley (1986b) reported that one department granted technologists far less
autonomy than the other. The department was characterized by stricter work rules, more circumscribed roles, and hierarchical tensions more characteristic of industrial rather than professional relations. The contrast between the two sites existed regardless of the technology examined, even though within each site the technologists who operated newer technologies enjoyed more discretion than did their counterparts who tended radiology's older machines. The dynamics of cultural shaping became more obvious as the two departments adjusted their first CT scanners. As might be predicted, radiologists in the first hospital sought to retain more control over the scanner's daily operation than the radiologists in the second, where technologists had traditionally been granted greater discretion.

The primary intellectual trends that have developed in the last quarter century, noteworthy in the sociology of work, include the growth of survey research on work attitudes (job satisfaction); the increasing influence of Marxist theory; and the rise of "new structuralism" (how the characteristics of institutions affect the distribution of job rewards) Diprete, 1988.

The survey research that developed primarily between the 1950's and the 70's (Kalleberg, 1977; Mottaz, 1985; Locke, 1976) focused on social psychological attributes reported by workers, especially job satisfaction without regard to context. Specifically, the survey responses were accepted as accurate without consideration of the norms that provide certain answers to questions or of discrepancies between attitudes and the respondent's actual behavior.
In the 1970's and 80's, Marxist work became increasingly important and influential in the field. The theoretical work of Braverman's *Labor and Monopoly Capital* (1974), affected the way research was conducted on the workplace. The impact of technology and alienation were addressed with models that provided a historical, macrostructural framework but limited discussion on workplace behavior. Economists in the late 20th century still argue as to whether the skills of workers are being upgraded or downgraded by technological advances and industrial growth. In *Labor and Monopoly Capital*, Braverman argues that technology is used by managers to devalue the skills of workers (Greenbaum, 1994). Braverman's central thesis is that there is a pervasive tendency in contemporary capitalism to reorganize jobs at lower skill levels (Clarket, 1978; Clawson, 1980; Greenbaum, 1979; Kraft, 1977). Labor process theorists such as Friedman (1977), Edwards (1979), and Burawoy (1979, 1985) emphasized the role of class power and economic exploitation and yielded models of the wage-labor relation apart from the actual experience of work in people's everyday lives. However, few of the major concerns that workers bring to their jobs such as security, tradition, and opportunity were not provided for in the models of labor process theorists.

A recent development in the sociology of work has been called the new structuralism (Baron & Bielby, 1980; Kalleberg & Berg, 1987). As with labor process studies, the power of this research comes from its macrosocial view of firms, industries, and occupations. The focus primarily on issues such as industrial variations in income inequality and labor market structures leaves analysis of the workplace removed from patterns of culture and the community at work. Although these analysts speculate about
the forces attributable to phenomena such as sex segregation in organizations (Bielby & Baron, 1986), the statistical data used do not permit explanation from the point of view of workers and their employers.

Even though Neo-Marxist and new structuralist studies have sharpened our understanding of economic inequality, remarkably little has been learned about the place of work in people's lives. A plausible explanation was given by Stern (1996). He stated that the increasing complexity of social relations made determination of an appropriate unit of analysis more difficult. One could ask "What conceptions does the worker hold about their work? How do they identify with their jobs? How are the boundaries between the workplace and the wider cultural environs experienced?" In short, the concepts of workplace culture and occupational communities and identities have not been explored and occupational sociology is the poorer for it.

Sallie Westwood (1982), has been instrumental in providing textured accounts of work life. Her study of women textile workers demonstrated how these workers sought to domesticate their workplace by drawing on their roles in the family to gain a measure of freedom from their male overseers in the factory. A similar emphasis on the nature and sources of workplace culture can be found in the research of Lamphere (1985), Yarrow (1987), and Kimmel (1985). Their rich descriptions and analyses have shown that workers are not passive, obedient creatures, but active beings who imbue their work situations with meanings and who respond to work demands in ways that reflect involvements outside the sphere of work.
The last quarter century has added to our knowledge of the organizational bases of work attitudes. Occupational sociology has gained an understanding of the varied forms of control over work that have developed under industrial capitalism and of the role of firms and industries in fostering economic and social inequalities. What has not been developed are themes involving the meaning of work and patterns of workplace culture and identity. These issues, once the central object of social research, have been relatively neglected. The social perspective of work is not likely to advance unless we look at the meanings workers attach to their jobs, the non-work spheres of life, and the wider culture of our society (Barley, 1996; Vallas 1990).

Section II: Effects of Technology on the Labor Structure

During this recent period of global restructuring there has been more and more of a focus on the relationship between technological change and organizational change. Competing perspectives have emerged from the literature with regards to this topic (Hodson R. and Parker R, 1988). One emphasizes the positive aspects flowing from the introduction of new technologies. The themes of Daniel Bell’s (1973) seminal work on the "post industrial society" are central to this perspective. Following in the footsteps of Bell’s position are Leontief and Duchin (1984), who see automation liberating individuals from mundane, routinized work tasks. Gerald Piehl (1983), the publisher of Scientific American, views technology as the major vehicle that brings better standards of living to the populous.

The other perspective describes the role of technology in negative terms. The seminal work of Braverman (1974) on the "deskilling of work" in modern society is central to this
perspective. A recent proponent of this perspective is Noble (1977, 1979, 1984) who argues that there is nothing automatic about the development or consequences of automation. He believes that technology is a business tool used to increase management’s leverage in collective bargaining. Noble argues that where options exist employers systematically select the kinds of technologies that weaken labor autonomy and solidarity.

One may also glean conflicting evidence on technology's implications for the organization of work from research on similar technologies used in different organizations. In a study of two radiology departments that recently acquired identical CT scanners, Barley (1984), found that CT technologists in both departments exercised more discretion than did technologists who operated traditional x-ray equipment. Yet, the degree of autonomy granted the CT technologists varied considerably between the two hospitals. Neither the sociology of automation nor deskilling theory can account for the same technology's capacity to occasion contrasting social orders in different contexts.

In addition, labor relations in the industrialized market economies today are being played out against a backdrop of economic constraints, technological innovations, and various quantitative and qualitative changes in the labor market (Rosenthal, 1995). Noble Cooley (1980, 1982), and Kraft (1977, 1984) argue that emerging technologies are not inevitable but instead reflect economic and social forces. Cooley argues that automated technologies have displaced workers' skills and have had a profound impact on motivation. Kraft argues that technology and especially computer based technologies have been used to centralize rather than decentralize management control. He emphasizes the point that computer based technologies are fundamentally different than older forms
of mechanization with the key difference that computer based technologies can be applied to a much broader range of workplace situations.

Similarly, Shaiken (1979, 1984) believes that computer based technologies at the workplace have deleterious effects on the worker. According to Shaiken, two factors that occur when control and input are removed from workers and placed in computer and other advanced forms of technology is that: 1) work becomes less human and 2) inefficiency increases because quality work always requires human input. Shaiken agrees with Noble and Kraft in that he sees the introduction of new technologies as a consequence of management's desire to maintain control over the work force.

From a broad perspective, three core areas of disagreement exist (Attewell, 1988): First, new technologies are transforming the skill requirements of different kinds of occupations, especially production workers and technicians. Hence, the continuing debate about enskilling vs. deskilling. Secondly, there is the changing structure of occupations generated by advanced technologies. The concern here is with the kinds of jobs produced and the kinds of jobs displaced by advanced technologies. Hence, the continuing debate about the "two-tiered" occupational structure. The third disagreement revolves around how working conditions are being modified by advanced technologies. Specifically, the focus is on the way advanced technologies are affecting organizational structure and job satisfaction. Finally, at the core of this discussion is the emergence of a series of powerful new industrial technologies, which is giving rise to the multiskilled health workforce in which innovation and production and intellectual and manual labor are becoming increasingly integrated (Florida, 1991).
Other changes that have occurred in the health care industry and continue to affect manpower needs are:

1. Advancing technology that requires new skills, while making some of the more traditional skills outdated;

2. Changes in the population characteristics, with a growing number of elderly, whose health care needs require different skills and knowledge than have been typically emphasized in health occupation programs;

3. Providing more health care services outside the hospital in outpatient surgeries, physician offices and HMO's;

4. Early discharges from hospitals, often before patients or families are able to provide the technical care needed, resulting in an increase of patients in long term care with a demand for home health care services; and

5. Demand for greater productivity and flexibility in personnel and ability to adapt to changes.

This has been described in the American Hospital publication, "Effects of the Medicare Prospectus Pricing System on Hospital Staffing" (1985), as follows: "Staffing has been necessarily adaptive, tied to budget and a prime target of cost reduction" (page, iv). Furthermore, the report lists the following strategies to help decrease labor costs:

1. job restructuring by using criteria based on job descriptions and performance standards;

2. hiring of more versatile professional staff;

3. cross training and retraining as well as;

4. the generation of several new positions described as the multicompetent technician (AHA, 1985)

Additionally, the MSHP Clearinghouse has provided their own rationale for the use of MSHP's and the multiskilled model as three fold (Lundy, 1996):
1. Specialization has inherent limitations and has been taken to extremes in health services. As noted by Sabel, (1982) there is an inherent conflict between the idea of craft as an ensemble of skills and Fordist principles of routinized mass production of standard goods. Once management began to apply Fordist principles, the routinization of tasks quickly comes into conflict with the autonomy inherent in the principle of craft production. According to Sabel, three inherent conditions are noted:

   a. Increasing the development of tasks into smaller units requiring less skill produces a steady and equal erosion of the skills of all workers in the plant.

   b. While increasing the development of tasks slowly decreases the average skill level, some craftsmen will be able to augment their individual skills.

   c. The MSHP position is a meeting ground for workers threatened with disqualification by technological change and workers when technical change offers opportunity for advancement.

2. New approaches to organization and job design are needed. Consistent with this theory, the MSHP Clearinghouse has proposed on-the-job training for unskilled workers. Industry has learned that when workers are limited to a set of functions with great variation in products (such as in patient care), these demands will cause frustration and will actually produce stress that leads to increased absenteeism. This can result in more wasted time and higher costs for the employer with less satisfaction for the consumer/patient. Furthermore, when workers compete with one another and skill levels are different there is a greater possibility that these shifting work assignments provoke disputes about pay, work load, and additional uncompensated responsibility (Sabel, 1985).

3. Need for flexibility in cross training

   As production becomes more mechanized, it becomes more prone to breakdowns or costly disruptions, so it is impossible to dispense with a core of highly skilled workers. Particularly, workers who can grasp the principles of a given technology abstractly enough to be able to repair defects that occur for the first time. The cost of training and staff development for more categories of employees is significant and currently there is no published data on the costs incurred by MSHP (Manual et al., 1994).
Many recent theorists have claimed that the present period marks a watershed in the capitalist economy, presaging qualitative shifts in the nature of work (Pahl, 1989). Some see scientific and technological change as the driving force. As cited above, others stress economic and organizational processes involving the remaking of managerial authority (Heckscher, 1989). Still others suggest that the future of work will be shaped by the relative powers of the combatants (i.e. corporate elite's and the working classes).

Most scholars agree on is that the older work arrangements that characterized mid-century America are now fading into memory. With regards to the health care industry what will replace them? Technological innovations have changed how jobs are completed, how labor is divided, and how organizational environments function. What can be suggested is the generation of an hypothesis that includes how organizations manage the completion of jobs, how labor is divided, and how organizational environments can best function in light of new and ever increasing technologies.

Section Three: The Enskilling/Deskilling Debate

Research and events in the last twenty years have had a profound impact on our current view of Braverman's (1974) Labor and Monopoly Capital. It has been argued that while Braverman's work brought together and reconfigured stratification theory and industrial sociology, its findings have become conventional wisdom, and the field has moved very far from his conclusions. A series of challenges to Braverman's thesis include his notion of managerial strategies of control, the effects of the deskilling process, and the reintroduction of subjectivity into the workplace environment.
Given the thesis that automated technologies absorb skill by their physical design, deskilling theory might at first appear to be a straightforward revival of Marx's materialistic critique of capitalist economy. As such, deskilling theory would differ from the sociology of automation mainly in its interpretation of events. Whereas the sociology of automation offers an optimistic view of the future by focusing on differences between machine and process production, deskilling theory could be said to promulgate a darker view by contrasting all technical regimes to the social organization of craft work (Littler 1982). The critical distinction between the two approaches begins with deskilling theory's claim that technology is essentially a social phenomenon. Whereas the sociology of automation traces a technology's ramifications to its physical attributes, deskilling theory interprets technical properties as the realized intentions of the technology's designers. Therefore, technologies do not deskill simply because they constrain forms and relations of production, but because their constraints are intended. Because a technology's social problems are thought to stem from the intentions of its fabricators, deskilling theory ostensibly opens up the possibility of a voluntaristic theory of technical change. If technologies entail negative social consequences because they embody the intentions of their designers, then presumably their negative consequences could be averted by altering design criteria. Deskillers rarely sustain such an argument. Instead their discussions move rapidly from voluntarism to determinism and reflect the paradigm's presumptions about the cultural complex in which technology is embedded.

Based on a review of the literature, skill research in occupational sociology has been critically assessed. Although recent theorists have tended to dismiss the deskillling theory
(Hull, Friedman & Roger, 1982), the research findings remain equivocal. Despite their inability to measure compositional shifts in skill, case studies will continue to play an important function. New lines of inquiry have emerged, indicating a growing consciousness of the limitations of the dominant theories of skill.

Case studies of occupations supporting the deskilling hypothesis (Herdman, 1992; Austad, 1995; Kelly, 1988) have typically been sensitive to the internal heterogeneity found within occupations, and to the fact that the boundary between adjacent occupations located on the same functional hierarchy can shift over time. These factors are explicitly taken into account by a study of historical data regarding the clerical work in the US civil service (DiPrete, 1988). DiPrete provides compelling evidence that the thesis of clerical downgrading is supported by an alternative explanation, that of status redefinition, an aspect of the process of professionalization. It is suggested by the case studies of occupations that researchers should focus on functional hierarchies, rather than specific occupations, in order to avoid the problems that arise when occupational boundaries change. For example, in a study by Ruth Milkman (1991), worker surveys and interviews with workers, managers, and unions explored the impact of technological change and reorganization at a General Motors Plant in Linden, New Jersey. Milkman found that skilled workers experienced skill upgrading and increased responsibility whereas production workers underwent deskilling and were increasingly subordinated to the new technology.

Focusing on the social transformation of nursing work from a period of 1970-1990, Herdman (1992) conducted an interesting study on the validity of the enskilling thesis as
it applied to registered nurses. As a case study of nursing work, the thesis builds upon feminist analyses of sex based occupational segregation and Braverman’s 1974 analysis of the transformation of the labor process under monopoly capital to examine how patriarchy and deskilling operate in the workplace. By examining the transformation of nursing within the context of professionalization and rationalization, the study reveals how both internal and external forces influence the nature of change within an occupation. By examining the nature of nursing work from the perspectives of nurses’ experiences in an organizational setting within the wider social context, the study provides an alternative to the enskilling thesis: it provides evidence that nurses have been deskilled in a number of ways. Most importantly, the study revealed the fact that the rhetoric of the dominant group in nursing does not reflect the reality of nursing experience as it affects the majority of practicing nurses. The idealized image of nursing reflected by the dominant nursing discourse obscured the conflict and power struggles that are at play in nursing.

On the other hand, appropriate forms of control strategies have been introduced in specific occupations in order to counter the effects of deskilling. Such was the case in a study conducted by Ehi (1979). The author noticed that hospital nurses occupy a contradictory position in the mode of control and delivery of health care. Their ambiguous position and the way that this has manifested itself in the occupational strategies adopted by British hospital nurses was the focus of his study. It was largely based on an intensive study of the organization of work, the attitudes and the work behavior of strategically selected nurses in one area Health
Authority (Westmid). But it is a central argument that consciousness relates to specific historical situations (both objective and cultural) and must be understood in relation to these. The author shows that an adequate understanding of nurses' attitudes to work and their occupational strategies depend upon locating the occupation within the changing relations of control and delivery of health care. The historical development of nursing in Britain is traced in order to locate analysis of present practices in its proper context, and the emergent situation is then analyzed. It is shown that the present situation of the nurse, as in the past, is characterized by a paradox: progressive deskilling and hierarchical control versus the potential for autonomy in the health labor process. This ambiguity is likewise reflected in the attitudes of nurses to work and to professionalism and unionism as appropriate forms of occupational strategies. These occupational strategies are ways in which enskilling can become a reality: to increase autonomy and decrease management control, increase wages, increase skill development and responsibilities, and increase the dichotomy of lower class workers from the professional.

In summary, part of the reason that social scientists have been unable to clearly specify the influence of advanced technology on skill requirements is that advanced technologies appear to have divergent influences on different jobs. From the literature, it appears that advanced technologies tend to reduce the number of low skill jobs more dramatically than they reduce the number of middle and high skill jobs, thus raising overall skill levels. Even this effect is compounded by the fact that advanced technologies displace labor in general, driving up the unemployment rate and placing additional pressures on workers at all levels. The total effect of advanced technology on skill under
these conditions is highly indeterminate (Hodson & Parker, 1988). The answer that any particular researcher provides to the question of deskilling versus skill upgrading is highly dependent on which occupations he or she is studying and on whether account is taken of the additional effects of advanced technologies on the overall composition of the occupational structure.

Section IV: Workforce Training at the Post-secondary Educational Level

One of the major challenges to America's economic competitiveness is inadequacies in human resources, specifically a lack of preparedness among entrants to the workforce (Marshall and Tucker, 1992; Reich, 1991, 1995). According to the Secretary's Commission on Achieving Necessary Skills (1991), too few new employees enter the labor market with the skills needed to fill jobs requiring technical sophistication. Often prospective workers are not ready or able to learn advanced academic or technical skills (Carnevale, Gainer, and Meltzer; 1990).

Corson and Silverberg (1993) are among those who argue persuasively that the existing educational system is failing non-college bound youth, limiting their potential to make the transition from schooling to stable, high wage employment: "America's emphasis on college preparation has isolated academic from vocational education and weakened schools' ability to prepare youths for the demand of employment. Many youths, particularly those confronted with depressed local job markets and evidence that high school completion does not lead to rewarding employment, view the link between academia and successful employment as tenuous" (p.3).
What does research then suggest about the status, prevalence, and success of school-based and work-based programs in community colleges? What is the history of their use there? What is their future? This section of the review of literature will attempt to answer these questions paying particular attention to what is known about the effectiveness of the triad of relationships existing between academic and vocational education, education and employers, labor organizations and post-secondary education.

Community colleges have a long and rich tradition of offering liberal arts-transfer and occupational-technical education programs for youths and adults (Cohen and Brawer, 1989). Since the 1960's and 70's, a primary function of all types of community colleges (including junior colleges and two year post-secondary technical institutes) has been the delivery of occupational-technical education. Factors such as increased support for post-secondary vocational education by federal policy, changing demographics, and industrial changes, have had an impact on the growth of occupational-technical education.

Since the early 1980's, community colleges have become increasingly active in providing economic development, including technology transfer, particularly for small and medium sized firms (Grubb & Stern, 1989). A number of reasons have been cited for the increased participation of community colleges in technology transfer (Bonewit, 1984, Breuder, 1988). First, community colleges are geographically dispersed throughout states so they are located close to the public and private sector clients. Secondly, community colleges are highly visible and accessible to their communities and their constituents. Third, many community colleges have established a successful network and track record
of meeting personal, community, and industrial needs for education and training through traditional college courses or customized training programs (Bragg, et. al. 1991).

The involvement of community colleges in technology transfer is designed to assist in the movement from one arena to another through a multi-state process (Goetsch, 1989). Historically, the universities saw the movement of new technologies from research laboratories to vendors in commercial settings where the technologies could be produced and marketed. As Goetsch points out, community colleges have been playing an important role in all stages of technology transfer, but specifically in the diffusion and adoption stages where the need for education and training is particularly high. According to Goetsch, the community college role has paralleled the needs of potential technology users and has been threefold. First, community colleges improve the awareness of decision makers about new technologies available in the marketplace and assist with the decisions to acquire new technologies. Secondly, colleges educate workers about the features of new technologies to help overcome reluctance and fear. Third, community colleges have been retraining and upgrading the academic and technical skills of workers, thereby enabling public and private industry to operate new technologies efficiently and productively.

While technology is typically viewed as equipment or machinery, it can also be conceptualized as methodologies for extending human capability and enhancing social settings (Schon 1967, NSF1983). Based on this view, Jacobs (1989) described technology transfer as more than the simple adoption of a tool or method, but involving much more
interaction between the user and the technology. He concurred that community colleges should play a greater role throughout the entire process of technology transfer.

Taking a critical view of vocational education Boesel, Rahn, and Diech (1994) commended post-secondary vocational education saying, "Post-secondary vocational programs provide more structure and greater economic gain than their secondary counterparts for students working toward a degree. Post-secondary completers are more likely to find jobs related to their training, and with even some course taking without completing a program seems to confer labor-market benefits. These advantages of post-secondary vocational education seem to be most pronounced in public in community colleges" (p.17-18).

Research conducted by Grubb (1995) confirmed this finding. In a secondary analysis of the Survey of Income and Program Participation, Grubb showed that this was particularly true for persons who complete a program and gain a credential, who are nontraditional and enter job-related training upon graduation.

Increasingly, community colleges have been partnering with secondary schools to implement school-to-work related educational reforms beginning at the high school level. Initiatives such as tech-prep and youth apprenticeship programs are requiring community colleges to help high school youths make the transition to post-secondary education. Although the involvement of community colleges has not yet fully developed with these school-to-work reforms (Bragg, Layton, and Hammons, 1994) public policy is encouraging (and in the case of tech prep legislation) two year colleges play a pivotal role.
Of the numerous approaches to work-based learning, professional-clinical training and co-op programs are the most prevalent in community colleges (Bragg, Hamm, and Trinkle, 1995). Most community colleges offer health occupational programs, and nearly all of these programs require that students participate in the professional-clinical training. The Office of Technology Assessment (1995) reports that the clinical training model has become the norm for preparation in all the medical occupations ranging from nurse's aide to medical technologist. With the clinical training approach, students complete a combination of academic and vocational coursework in classrooms and laboratories on campus. In addition, they engage in learning at the work site (i.e., clinic or hospital) where students earn college credit and eventually obtain a credential in the profession.

Of the components central to work-based programs, connecting activities are the least understood. Although some employers participate in connecting activities, community colleges have had the primary responsibility for ensuring effective connections between school-based and work-based learning (Bragg, Hamm and Trinkle, 1995). From a grand perspective, the literature shows that there is an imbalance with regards to who (i.e., academe or labor organizations) has the responsibility for skill development. At this time, community colleges have the primary responsibility for performing all facets of the connecting activities, including selecting and training workplace mentors; assessing and certifying students' academic, technical, and workplace skills; and placing students in full-time employment upon graduation. Besides providing adequate supervision of students engaged in work-based learning, many employers have made minimal
contributions (Bragg and Griggs, 1997). Therefore, it has become increasingly important to document and disseminate the effectiveness of school-to-work systems in order to identify their specific shortcomings (Bragg and Griggs, 1997).
CHAPTER III: METHODS

The discussion of the methods section presented here is divided into seven sections: introduction, description of the study design, sampling method, method of data collection, the data collection instrument, interview cover letter, and the data analysis plan. The pilot study, categorical analysis of data obtained from the pilot interview, and summary are included in the appendice.

Introduction

The purpose of this study is twofold:

1. to explore the effects of technology on organizational work practices of the MSHP, including incentive structures, wages, issues of autonomy/authority, and skill development addressed by research question numbers one, two, and three; and

1. to investigate the extent to which the formal educational program of the MSHPs adequately prepared them for the changing health care work place addressed by research question number four.

In this research, I focus on the MSHP radiologic technologist who works primarily in diagnostic radiology but who also performs duties in any of the following areas or combinations thereof: Mammography, Nuclear Medicine, Computerized Tomography, Magnetic Resonance Imaging, Cardiovascular Interventional suites, and Ultrasound.

The MSHP radiologic technologist was selected over another MSHP health care worker for a variety of reasons. First of all, although radiologic technology is a discipline that originated at the turn of the century (following Wilhelm Conrad Roentgen’s discovery of x-rays in 1895), little is known about how this particular discipline has adapted with the transformation of work occasioned by the Second Industrial Revolution. With the
advent of computerization in Radiology in the sixties, a number of new imaging modalities have "sprung up" offering a new diagnostic tool for the health care physician. Although current organizational and managerial theories have focused on the dynamics of markets and populations, they are relatively devoid of how technologists within this particular discipline are trained for what they do and the way their traditional role has been affected by advancing technologies.

Secondly, there is a heightened curiosity by the researcher and diagnostic radiologic technologists about the dynamics of becoming, and ramifications of being, a multiskilled worker in the Radiology department. For instance, questions asked by this group include the following:

1. How is an individual selected for this position?
2. Will I receive any compensation for my new assigned tasks?
3. How will I be trained for my new duties?
4. What will be my perceived "fit" in the department?
5. Will I have more autonomy and authority in the imaging area that I am assigned?
6. What will the Radiologist expect of me and how will I be treated?

By not studying the transformation that has occurred and is still occurring with regards to this particular group of MSHP radiologic technologists, organizational and managerial theorists may promote theories that describe shifts in organizations without coming to terms with the internal microsystem complexities.

This study provides information both on how well the MSHP's formal education adequately prepared them for the changing health care workplace and on the effects of
technologies upon incentive structures, wages, autonomy/authority, and skill development. It is hoped that the analysis can be used to shed new light on one new model of work and relations of production that reflect changes in the division of labor and occupational structure of a post industrial economy (Barley, 1988).

Study Design

There are a total of twelve community hospitals located in the Tucson Arizona metropolitan area. Tucson was chosen due to the researchers' geographic and hospital familiarity. Of the twelve, two hospitals are military; one is a psychiatric facility; one, county owned and operated; six are acute medical and surgical facilities; one is a teaching hospital; and the other is a full service emergency/heart attack intervention center. There are two 24 month Radiologic Technology education programs; one is a proprietary school and the other is located at a community college. There are a total of 584 certified technologists working in the Tucson metro area. Of this total, 91 are classified as multiskilled (ARRT, 2000)

Approximately half of the Tucson hospitals within the metropolitan area are classified as non-profit organizations and the other profit. Of the eight hospitals selected for this study, six are non-profit and two are profit. The largest (hospital #5) with a bed size of 531 has approximately 2,500 full-time equivalent employees. The smallest (hospital #7) with a bed size of 166, has 600 full-time equivalent employees.

The most important characteristic relevant to this study is the penetration of health maintenance organizations. There are 7 major HMO's in the state of Arizona that include 1,474,470 members and 55,052 contracting physicians for 194 contracting hospitals
statewide. Exact statistics for the Tucson metropolitan area were not available despite extensive efforts to secure this information. With such a large network, clients can chose from a wide variety of plan options and services under a tightly controlled pricing plan.

The research involves multiple case studies, is qualitative, and is exploratory in that it seeks to examine the MSHP radiologic technologist. It does not test an hypothesis in a strict sense. It is grounded in analytical categories and theories derived from the literature on technology, work, occupations, and organizations. The data from the multiple case studies presented will identify first the characteristics of the Radiology Department found in each chosen hospital in metro Tucson, second the number of MSHP in each hospital and what modalities they have been assigned to, and third the relationship between the structure of the Radiology department and the MSHP.

In the exploratory portion, I consider the perceptions of the respondents with regards to their work and its connection to their formal education, the hospital in which it is performed, and the patterns of interaction with fellow co-workers and the radiologist. I also consider the impact of new technology on incentives, wages, and the MSHP's perceptions of autonomy/authority and skill development. Such data regarding what people do and how they do it is particularly valuable in this field of study (Barley, 1988).

**Sampling Method**

The population of Hospitals

There are twelve licensed community hospitals in the Tucson Metropolitan area. The study was conducted in eight of the twelve Tucson Metro Hospitals. The eight hospitals chosen met the following criteria: size (greater than 100 beds) and availability of long
term care services (provided by acute care hospitals). The population for this study was selected so that it would adequately reflect two characteristics of the general population, which could have an influence on how radiologic technologists are used: 1) specialized long term care services; and 2) size of the hospital. Hospitals that provide long term care services are required to provide services and staff for Medicare/Medicaid reimbursement. Hospitals with one hundred beds or more have a higher daily patient census and can support more technical staff. Four of the twelve hospitals were dropped due to bed size (less than 100 beds) and two of the four dropped were specialty hospitals (one was a psychoactive facility, and one was a military base hospital) that were unable to support the use of at least one or more imaging modalities financially. The third hospital did not have any MSHP radiologic technologists that met the operational definition. Specifically, all MSHP radiologic technologists at this facility spent 100% of their time in the imaging suite. At the time of data collection, the fourth hospital selected for this study closed due to financial bankruptcy and was eliminated from this study. Since technological influence depends in part on the specific historical process in which it is embedded, it is important that the chosen hospitals had similar histories (date of inception 50 or more years) and workplace settings (radiography department that provided a number of diagnostic services including one or more imaging modality). The eight hospitals chosen from the population are over 100 beds with the smallest at 106 beds and the largest 623 beds. All have Radiology departments that offer a number of different imaging modalities or combination thereof.
Traditional Organization of the Radiology Department

For the eight hospitals selected for this study, the Radiology Department is located in one particular area of the hospital. Exceptions may include a new imaging modality that has been set-up outside the department due to room availability shortages, or a combination of imaging modalities (primarily CT/MRI) located in a separate imaging center that is not affiliated with the hospital. Because hospital personnel do not staff these imaging centers they were eliminated from this study.

The radiology department is further subdivided into various imaging suites. Depending on the institution, the suites include a general diagnostic radiography/fluoroscopy room(s), and any combination of the following modalities: mammography, ultrasound, CT/MRI, nuclear medicine, and cardiovascular/interventional. Hospital Imaging modality distribution and longevity are provided in (see Table 1, page 50).
**TABLE I**

**HOSPITAL LONGEVITY**

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<th>Imaging Modality</th>
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**KEY:**

A = 1-5 Years  
B = 6-10 Years  
C = 11-15 Years  
D = 16-20 Years  
E = > 20 Years
Organizational Structure of the Radiology Department

For the eight hospitals selected for this study, each Radiology Department had basically the same type of vertical organizational structure of which radiologists were not a part (see Table II, page 53). Apparently, the radiologists have their own structured organizational tier. Upon analysis, there was one designated individual who served in the capacity of Director of Medical Imaging. This individual was responsible for overseeing the entire operation and management of various support staff. This position has no authority over nursing and physician staff. The term "medical imaging" connotes a compendium of non-imaging areas/individuals (i.e., patient care assistant, radiology clerk, transcriptionist and clinical practitioner) and imaging areas/individuals (imaging specialist I-IV, nuclear medicine technologist and medical sonographer). The manager located directly below the director supervises departmental employees and is directly involved in public relations. The structure is then further tiered from those who are paid the least (patient care assistant) to those who are paid the most (clinical practitioner). It is interesting to note that those positions paid the most are either hardest to fill (i.e., nuclear medicine technologist, medical sonographer) or the educational requirements for the job is closest to a radiologist (i.e., clinical practitioner). An imaging specialist I is a radiologic technologist whose primary duties are diagnostic radiography. Imaging specialist II through IV incorporates any radiologic technologist who not only performs general diagnostic duties but in addition has one or more responsibilities in other imaging areas. For instance, a radiologic technologist who performs diagnostic duties and CT would be considered an Imaging II specialist. A radiologic technologist who performs general, CT
and MRI would be an Imaging specialist III, and so on. The imaging specialist II through IV represent the multiskilled health practitioner and is the focus of this study.
**TABLE II**

ORGANIZATIONAL STRUCTURE OF THE RADIOLOGY DEPARTMENT

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DIRECTOR OF MEDICAL IMAGING  
(Oversees Operations & Management)
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MEDICAL IMAGING MANAGER  
(SUPERVISES EMPLOYEES/PUBLIC RELATIONS)
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PATIENT CARE ASSISTANT
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RADIOLOGY CLERK
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TRANSCRIPTIONIST
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IMAGING SPECIALIST I
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IMAGING SPECIALIST II
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IMAGING SPECIALIST III
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IMAGING SPECIALIST IV
```

```
NUCLEAR MEDICINE TECHNOLOGIST
```

```
MEDICAL SONOGRAPHER
```

```
CLINICAL PRACTITIONER
```

*Obtained from Hospital #2 Radiology Department*
Selection of the Sample of Radiologic Technologists

The sample of MSHP radiologic technologists was selected from the population of relevant personnel working at eight acute care Tucson metropolitan hospitals. That population consisted of all radiologic technologists who function primarily in diagnostic radiology but who have been asked to perform duties in any of the following areas or combinations thereof: Mammography, Nuclear Medicine, CT, MRI, CVIT suites, and Ultrasound. Using the criteria, the number of MSHP radiologic technologists available in the eight Tucson metropolitan hospitals was 56. I interviewed a total of 33, which was a minimum of four from each chosen hospital.

Characteristics of the Sample of Radiologic Technologists

The Radiology Department is staffed with a group of professionals (the Radiologist), paraprofessional staff (the Radiologic Technologist), and other support staff (clerical personnel, file clerks). The Arizona Medical Radiologic Technology Board of Examiners requires that all persons who provide ionizing radiation to the public must obtain a license to practice. These licenses are for all types of diagnostic exams. The Radiologic Technologist has usually completed a formal two-year program and passed the American Registry of Radiologic Technologists Examination. A minimum of 24 continuing education credits must be completed every two years to maintain licensure. Any technologist who wants to pursue other imaging modalities can receive one additional year of formal education and pass an advanced level examination. However, at this time there is no law requiring formal education and additional licensure, and many of the technologists presently working in mammography, CT, MRI, CVIT, Nuclear Medicine,
and Ultrasound have obtained training by other means such as on-the-job training and cross training. The primary role of the Radiologic Technologist is to provide high quality radiographs for the interpretation and diagnosis of disease by the Radiologist for other physicians.

**Contacting the Sample Population**

Initial contact by the researcher was first made with the radiology department supervisors at each hospital chosen for this study. The supervisor was asked to provide a list of radiologic technologists who met the operational definition for this study. From this list, a minimum of three individuals were randomly selected from each hospital and contacted in person. At that time, I explained the purpose of the study, initiated a request for participation and provided a copy of the interview questions. A date and time for the interview was then arranged and completed.

**Method of Data Collection**

The interview method was the principal data gathering method utilized. The interview has a number of advantages and disadvantages. It can produce in-depth data not possible with a questionnaire, which is important for the exploratory portion of this research. It is most appropriate for smaller samples instead of the large numbers that survey questionnaires often target. The interview is useful for asking questions that cannot effectively be structured into a multiple choice format, such as questions of a personal nature that will be used for this research (i.e, negative/positive conceptions of work). In contrast to the questionnaire, the interview is flexible; the interviewer can adapt the situation to each subject or each hospital radiology department. Since the interviewer can
explain the purpose of the research and clarify questions, more accurate and valid responses can be obtained. Probing questions may be used by the interviewer to follow up on incomplete or unclear responses.

Additionally, the researcher is a Radiologic Technologist who has extensive field experience (particularly in diagnostic, mammography and CVIT) and a faculty member at a community college in the Tucson Metropolitan area. The advantages of this type of connection for the researcher include a familiarity with the role and responsibilities of the MSHP within a radiology department and, if the interviewee is a graduate of the researchers’ program, a thorough understanding of interviewees’ formal education.

A distinct disadvantage of the interview method is interviewer bias. To decrease the possibility of a bias the same questions were asked of each respondent and the same definitions and clarifications were given at all interviews. A disadvantage to this relationship is that the responses given by an interviewee may be biased and affected by his or her reaction to the interviewer, either positive or negative. Another distinct disadvantage is that for those individuals who received their formal education from the institution with which the researcher is associated they might be less willing to discuss the deficiencies of the program. To overcome this potential subject/interview bias, respondents were asked to speak candidly and honestly about their formal educational experience (foregoing any possible short or long term implications from their responses).

Since the number of interviews accounted for only 60% of the total MSHP population, generalizeability of the data may be minimized. Other disadvantages is that the interview process can be time consuming, expensive, and require a variety of
communication and interpersonal relations skills that go beyond that of a beginning researcher.
Dear Interviewee:

The health care industry is a social institution in transition. Many of the changes occurring in the health care industry are reactions to environmental changes, complex technologies, the provision of services, the proliferation of HMO's, and government intervention in health care delivery (Barker, 1986; Raffel, 1984; Hatch, 1986). These changes are affecting the labor force by shifting familiar patterns of the nature of work and more importantly the values and expectations of those who work. As a result, hospitals are using several strategies to manage labor costs, such as job restructuring to increase staff productivity. Job restructuring often requires personnel to function as multiskilled health practitioners.

For my dissertation topic, I am investigating in what ways your formal educational program prepared you to be a Radiologic Technologist Multiskilled Health Practitioner, and the effects of technology upon organizational work practices in hospital settings. For purposes of this research, the Radiologic Technologist multiskilled health practitioner is defined as a health care professional who provides primary services in the Radiology Department but can function in a variety of one or more of the following areas: Computerized Tomography (CT), Magnetic Resonance Imaging (MRI), Mammography, Nuclear Medicine, Cardiovascular Interventional Procedures (CVIT), and Ultrasound.

In undertaking my dissertation, I am conducting a pilot interview that will allow me to examine the efficacy of the particular questions and interview questions that I have designed for this study. There are three parts to the interview. The first part is descriptive in nature and provides information about the characteristics of your Radiology Department and can be filled out prior to the interview. The second section is exploratory and will focus on your former educational program and the effects of technology on organizational work practices in hospital settings. The third section is summative in nature and allows you to provide an overall feeling of your role as an MSHP.

I will be contacting you by phone in one week to determine if you are willing to participate in the study. The interview will take approximately 20-30 minutes and will be scheduled at your convenience. A copy of the interview questions are enclosed. The information regarding individual hospitals and personnel will be kept confidential and will be reported only as summary information.
If you have any questions or concerns regarding the study, we can discuss them when I contact you or you can contact me at 206-3108.

Thank you for your assistance.

Sincerely,

Renee F. Tossell
Interview Questions: Interviewee Number; Hospital Number

I. Descriptive Section:

A. Characteristics of the Radiology Department

1. How many different imaging modalities exist in your hospital and how long has each imaging modality been available?

2. How many MSHP work in the department and how are they distributed among the various imaging modalities that are being used by your facility?

3. How long have you worked in the imaging modality that you have been assigned? (For future interviews this question will be modified to ask what percentage of your total weekly time is spent within this imaging modality?)

4. As an MSHP, how would you describe your new role and your "fit" in the existing departmental structure?

5. Have you seen changes in the number of MSHP assigned to your imaging modality area? If so, explain.

6. As an MSHP, would you say anything about your job or position that has changed with your new role and new assigned tasks? If so, explain.

II. Exploratory Section:

1. When each imaging modality first came into use how was it implemented and operated? Were technologists recruited from the diagnostic area to operate the equipment or was a technologist with specific expertise hired outside the hospital to operate the equipment?

2. If the technologist was recruited from the diagnostic area, what kind of training was the technologist given to operate the equipment?

3. Specifically, what subject areas of your formal education helped prepare you to become an MSHP? What deficiencies were there and in what ways do you think it could be improved to accommodate your needs?

4. What incentives (if any) did the Radiology department offer that attracted your attention to this position?
5. Describe your earnings before, during, and after assuming your new position as MSHP.

6. Once you established competency within your new assigned imaging area, at what point did you feel you had established competency and what lead you to believe this to be so? Specifically, are you able to do more without the Radiologist present then when you were in the diagnostic area? less? about the same?

7. If you compared the pattern of interaction you had with the Radiologist before your role as an MSHP to your new role, have you noticed any changes? If so, explain. (I will look for hints of power, changes in communication, autonomy, or role reversal).

8. When comparing your old tasks with your new tasks how would you describe the difficulty, and responsibility? Do you feel your new earnings are commensurate with your new assigned tasks? If not, please explain.

III. Summative Response Section

1. Overall, what positive and negative feelings do you hold about your new role and assigned tasks as an MSHP? What changes would you suggest to improve your new position?

Interview Schedule

Research Question 1: From a sociological perspective, what positive and negative conceptions do MSHP’s hold about their work and the organization in which it is performed, including patterns of interaction with the people invited to work with them?

The interview questions from the descriptive section of the schedule address the characteristics of the radiology department and the relationship of the MSHP to that structure. That includes their coworkers and most importantly the Radiologist. Data needed for this section was also obtained from the Radiology manager and included staffing/administrative structural plans. Specifically, the interview questions from this section were designed to provide focus on:
1. a look into the relationship of the structure of the institution to the MSHP: (i.e., vertical vs. horizontal hierarchical structure).

2. perceptions about how the new role of MSHP "fits" into the larger contextual environment.

3. perceptions of the job description as an MSHP

4. perceptions of status redefinition

Research Question 2: How has the impact of technology affected the MSHP's organizational work practices prior to and following implementation of their new tasks needed to meet technological demands, and how has their new position fit with regards to incentive structures, wages, issues of autonomy/authority, and skill development.

The interview questions from the exploratory section address:

1. how the MSHP was recruited from the diagnostic area (or outside the institution) to assume their new position

2. in what ways did their formal education prepare them to be an MSHP and how training was provided to operate the imaging modality to which they were assigned

3. explore what incentives (if any) attracted the MSHP to the new position

4. a comparison of the earnings before, during, and after their new responsibilities as an MSHP

5. perceptions of the authority placed in the MSHP's hands following competency of the imaging modality

6. changes in responsibility, authority and difficulty when comparing the old tasks to their new role as MSHP

7. a look into the changes of patterns of interaction with the Radiologist in reference to communication, autonomy, and instances of role reversal (if any)
Research Question 3: Within their hospital setting, have the new technologies reduced dependence on employees, uprooting workers' skills and deepening management control over the work process (deskilling) Or, has workplace automation relaxed the constraints imposed on human labor creating a new division of labor founded on commitment, responsibility, and social integration which promotes more innovative and participative models of workplace relations (enskilling).

The last question or summative response section of the interview provides a general impression of the MSHP's stance with regards to this particular question and is designed to provide an opinion from the MSHP based on the overall experiences with the imaging modality that they have been assigned.

Research Question 4: What ways did the formal education of the MSAP provide or not provide for necessary skills in which to perform their new tasks? Responses to this question are analyzed according to the responses from question number three of the exploratory section. Responses are analyzed according to curricular similarities and dissimilarities and suggestions for curricular modifications.

Following the data collection, responses for each question are analyzed for patterns of similarities and dissimilarities. Dissimilarities in the data may cue potential gaps with the interview questions and were or were not re-analyzed to ensure that pertinent data have not been overlooked in the final analysis.

A categorical analysis was implemented to organize the data. The categorical analysis will be arranged in the following way:
Hospital # One through Nine

Section A: Descriptive Data (Characteristics of Radiology Department)

I. Number of MSHP Identified
   a. Distribution of MSHP
   b. length of stay in imaging area (on future interviews this question will be modified to reflect the percentage of time spent in this imaging area on a weekly basis).

II. Number of Imaging Modalities Present
    a. history (age of modality)
    b. number of MSHP assigned to area

III. Structure
    a. department
    b. imaging area
    c. status of MSHP within structure

B. Section B: Exploratory Section
   (Educational Preparedness/Technological Effects)

I. Recruitment
   a. inside department
   b. outside department

II. Training
   Part One:
   a. cross trained
   b. retrained
   c. on the job
   d. inherent technical expertise
   
   Part Two:
   a. contribution(s) of formal education
   b. deficiencies of formal education
III. Incentives
   a. structural/power
   b. financial
   c. status redefinition

IV. Wage Comparison
   a. before placement
   b. during training
   c. after competency

V. Authority following competency
   a. informal
   b. formal
   c. neither

VI. Patterns of Interaction
   a. role reversal
   b. communication
   c. autonomy

VII. Task Assignments
   a. level of difficulty
   b. level of responsibility

III. Summative (Site specific)
   a. enskilling (empowerment, less managerial control, and increased opportunities)
   b. deskilling (routinized tasks, degraded, less autonomy, less responsibility)
CHAPTER IV: DATA ANALYSIS

The purpose of this chapter is to describe the results of the interviews conducted to explore what effects technology has had on the MSHP's organizational work practices including incentives, wages, issues of autonomy/authority, skill development; and determine how the formal educational program of the MSHP adequately provided or did not provide for the changing health care workplace.

The chapter is divided into four sections and encompasses four research questions:

Section One describes the results of the interview (i.e, descriptive section questions #4-6, explorative section question #7) that provides an investigation into the nature of the MSHP’s work, centered around the first research question: (i.e, From a sociological perspective, what conceptions do the multiskilled health care worker hold about their work and the organization in which it is performed, including perceptions about their co-workers including the Radiologist?) Section two describes the results of the interview that examined the effects of technology on organizational work practices (explorative section, questions #1-2, 4-6, 8) centered around the second research question: (i.e, How has the impact of technology affected the multiskilled health practitioner's organizational work practices prior to and following the implementation of their new tasks needed to meet technological demands, and how does their new position fit with regards to incentive structures, wages, issues of autonomy/authority, task difficulty and patterns of interaction?) Section three describes the results of the interview that addressed the MSHP with regards to the enskilling/deskilling debate (summative section, question #1) structured around the third research question: (i.e, Within their health care setting, to what
extent have the new technologies reduced dependence on employees? "uprooting workers" skills and deepening management control over the work process (deskilling) or has workplace automation relaxed the constraints imposed on human labor creating a new division of labor founded on commitment, responsibility and social integration that promotes more innovative and participative models of workplace relations (enskilling)? Section four describes the results of the interview (i.e.; Exploratory section question # 3) that directly pertains to the fourth research question: (i.e. What ways did the formal education of the MSHP adequately provide or not provide for the changing health care workplace).

Section I: Research Question No. 1

Section I is designed to describe the results of the interview that answers the first research question: From a sociological perspective, what conceptions does the multiskilled radiologic technologist hold about their work and the organization in which it is performed, including perceptions of their co-workers including the Radiologist?

The question was analyzed across modalities (i.e. non-specific to one type of imaging technology) and took into account responses form all 33 interviewees. The analysis sought to establish similarities and differences with regards to the MSHP's perceptions regarding their new role and "fit" in the imaging area (i.e, descriptive section question #4), changes in the number of MSHP's assigned to their imaging suite area (i.e. descriptive section question #5), the changes in their new role and assigned tasks as an imaging specialist (i.e. descriptive section question #6) and; the relational aspects or
patterns of interaction with the radiologist before and after becoming a multiskilled radiologic technologist (i.e., explorative section question #7).

**Analysis of Perceptions - Role and "Fit"**

When the MSHP respondents were asked to describe how they perceived their new role and fit within the Radiology Department thirty six percent (36%) of the MSHP respondents identified their new role and fit with regards to the established vertical organizational hierarchical structure as a Imaging specialist II-IV (see Table II, page 53). Specifically if they had achieved competency in one additional modality above general radiography they were now classified as an Imaging Specialist II. If two or more modalities were added to their competency level, they were classified as a Imaging Specialist III-IV.

Twenty-four percent (24%) described their new role and fit as possessing superiority over the general diagnostic radiologic technologist described as, "top-dog", "more clout", "needed", and "head technologist." The attainment of expertise within each additional modality provided the MSHP with a sense of importance not only within each imaging area that they worked, but also within the Radiology Department as a whole.

Twenty-two percent (22%) felt that the application of their new skills within their perspective imaging area contributed to the pursuit of "saving lives". Due to the ability of the technology to pinpoint significant pathophysiologic processes, the MSHP was involved first hand in the early detection of serious lesions not previously seen by other diagnostic tools.
Eighteen percent (18%) were hired at their facilities because of their inherent expertise and therefore never perceived of themselves as being anything other than an MSHP. That is, this group came from other facilities possessing the same level of skills needed to complete the tasks in the imaging areas that they were assigned.

**Summary**

The analysis indicates that the greater the number of MSHP in any modality the greater the competitiveness among them. If the particular MSHP in question did not hold superiority within the imaging suite, the greater they felt subordinated by others. For those individuals who did hold superiority within the imaging area by virtue of their experience and longevity, they possessed a greater sense of autonomy.

The particular modality of the respondent also mattered. For the twenty-two percent that were helping to fight the war on cancer as sonographers, they were challenged and felt empowered. They were saving lives. Finally, levels of expertise and experience mattered. The eighteen percent of my respondents who were hired into their present positions because of their inherent expertise did not express a change in their new role and fit.

**Analysis of Changes in the Number of MSHP**

Fluctuations in the number of MSHP assigned to anyone imaging area ranged from a minimum of two MSHP to a maximum of five. Hospital size relative to staffing imaging areas mattered. For instance, departmental records showed the larger the hospital (> 200 beds) the more likely the numbers of MSHP assigned to each imaging area remained constant. Managers attributed this to a fairly steady influx of physicians' requests for
examination. However, in smaller hospitals (< 200 beds) where the number of physicians requests for examination changed, the number of MSHP assigned to an area were more likely to vary. Or, as reported by 28% of the respondents, if during such a time an MSHP was to leave, management were less likely to fill the position.

Analysis of Changes in their New role and Assigned Tasks

Eighty-eight percent of the respondents expressed negativity with regards to the changes in their new role and assigned tasks. Responses provided by interviewees included the following assigned tasks:

a. requests by management for obtaining advanced level certification in assigned areas;

b. limited time within the modality to adequately perform required duties;

c. pressure for retraining to include a broader knowledge base and greater skill versatility;

d. increased responsibility, difficulty and stress not commensurate with negotiated monetary incentive; of non-monetary incentives;

e. greater demand for problem solving and critical thinking during procedures;

f. uncoordinated shift assignments; and

g. difficulty in maintaining a higher standard of performance between assigned areas.

Only 12% of the respondents provided a more positive response with the changes in their new role and assigned tasks. This was primarily attributable to "more autonomy" defined as being able to proceed with a scan from start to finish without supervision. "More authority" defined as the radiologist "stepping-back" during a procedure to allow the technologist to be the problem solver when the equipment malfunctioned; and
"greater job security" expressed by Imaging specialists II-IV for possessing multi-modality capabilities.

Although many MSHP's believed that their new situation involved an enhanced position professionally, the overwhelming majority expressed negative attitudes about their assigned tasks. This was primarily due to the increased pressures placed on the MSHP by management and radiologists. MSHP's felt squeezed between them. For instance, respondents experienced unplanned shift assignments which made them feel less dependable. Not having a set schedule in each area made the MSHP feel "rusty" and thus they could not maintain a high standard of performance between areas. Moreover, there was a greater sense of difficulty, responsibility and stress in the imaging area, and MSHP's believed these new demands were not commensurate with the negotiated monetary or non-monetary incentives. In other words, they were overworked and under resourced. They may have experienced a step up the vertical organizational hierarchical structure, but they had not received their just rewards, and managerial support to match. Finally, MSHPs believed the radiologists "pushed" them to retrain. The radiologist had requested them to obtain advanced level certification, and possess the ability to problem solve equipment idiosyncracies. On the other hand, those few (12%) who were not dissatisfied with their tasks tended to be the most experienced, credentialed, and highly ranked MSHP's.
Analysis of Patterns of Interaction

Compared to the general diagnostic area, 88% of the respondents expressed a more positive pattern of interaction with the radiologist in their new assigned areas. The comments expressed by respondents included the following:

a. greater autonomy defined as being able to proceed with a scan from start to finish without seeking input from the radiologist;

b. more respect or feeling like their expertise was held in the highest regard and at times allowed to play a role in the diagnosis;

c. "more relaxed communication" demonstrated by an increase in mutual respect, feeling "more on their level" with the use of a more informal professional address;

d. "higher level of confidence" in themselves and by the radiologists demonstrated by entrusting the technologist with a greater variety of tasks with less supervision; and

e. evidence of role reversal following the restructuring of a department using experienced technologists with residents (in-training radiologists) assigned to the imaging suite.

Eight percent expressed no change in the relational aspects with the radiologist from the diagnostic area to their assigned imaging suite. Only four percent expressed a negative pattern of interaction with the radiologists and co-workers after moving from the general diagnostic area to their newly assigned imaging area. Non-structured interview responses revealed that being able to work as a MSHP was considered to be a "privilege" and to coincide with a distinct level of prestige.

Additionally, the level of competency was directly proportional to the positive pattern of interaction with the radiologist. After gaining competency in an imaging suite, technologists were treated in a more respectable way by the radiologists. It does not come
as a surprise that the few responses about "belittlement" by co-workers and less respect by radiologists were offered by inexperienced MSHP's. These technologists constituted the group of new trainees who had not yet gained competency and were feeling the competitiveness and superiority of co-workers that were more experienced and able.

**Discussion of Research Question #1**

The most significant sociological perspective expressed by the sample was found in the patterns of interaction with the radiologist. Specifically, there was distinct stylistic differences that characterized the interactions within the particular imaging areas in comparison to the general area. These differences included changes in professional demeanor, respect, task versatility and assignment that were apparently shaped by an established stratified distribution of expertise among the radiologists and technologists within the imaging suites. The tenor of relations within the new modalities was distinctly different from the diagnostic area. Aside from the novelty and excitement within their specific imaging area, it was apparent from the responses that status distinctions were shaped by the more equal distribution of technical and interpretive expertise. Specifically, the more expertise that was gained by the technologist within the imaging area, the more equal the treatment (i.e., demonstrated by the greater the difficulty and versatility of task assignment) and respect granted by the radiologist(s). Additionally, it was apparent from the responses that general diagnostic x-ray technologists were treated as "employees," but imaging specialists were treated as members of a "team." Not only did a number of interviewees state that radiologists asked technologists for opinions, but also CT techs, cardiovascular/interventional techs, sonographers and mammographers believed that they
could affect the circumstances of their work through gained experience (Barley, 1990).

The most important interview question that revealed these distinctions was question #6 of the explorative section: (i.e., if you compared the pattern of interaction you had with the radiologist before your role as a MSHP to your new role, have you noticed any changes? If so, explain.)

The following selected excerpts illustrate these distinctions:

**Hospital #1, Interviewee #1 Response:**

I don't feel the same level of up or down with the doctors in the CT area. They are more dependent on you to do a good job. They expect more out of us and they let me call them by their first name.

**Hospital #1, Interviewee #2 Response:**

I think the radiologist shows more confidence in a tech with a wider variety of skills and he is more likely to assign a greater variety of tasks to me without a lot of supervision.

**Hospital #3, Interviewee #1 Response:**

If anything, it's almost that you are a little more on their level than when you were working in the RAD area. There seems to be more respect between you and the radiologist. It's more relaxed and I feel like I have more power in mammo.

**Hospital #3, Interviewee #2 Response:**

When I became a MSHP, my interaction with the radiologist definitely increased. I now had to assist on biopsies, go over protocols, provide patient history, provide lab results, etc. Once I attained the trust and confidence from the radiologist, I did feel a
sense of autonomy. They left me alone to vary and change studies to attain additional information, and would ask for my input or my thinking on certain things.

Hospital #4, Interviewee #2 Response:

Because I have proven to be a good mammographer, the radiologist shows me more respect and includes me in problem solving for the case at hand.

Hospital #4, Interviewee #3 Response:

I feel the radiologists have more confidence in me now and rely on me more to handle things. I feel like my opinion counts more now, and I feel like more of a colleague.

Hospital #7, Interviewee #1 Response:

If you are a MSHP, you are treated at a higher level of respect. Communication and decision making with the radiologist increase dramatically. Before my training, I definitely felt a separation.

Hospital #7, Interviewee #3 Response:

Yes, I have noticed that I will point out things that I see even on plain films. The radiologist also seems more interested in my opinion.

Hospital #8, Interviewee #1 Response:

Since we now have new radiologists to deal with and get to know, we are all back to the same level. They are getting to know us and our work habits and visa versa. They are very open to suggestions and I find that they help us in any way and are always willing to teach.
Hospital #8, Interview #3 Response:

I have always been a MSHP. As such the radiologist treats me as a "trusted tech." Changes that I have noticed is that when I am working with residents, I often have to advise them through a scan. Whereas with the regular radiologists, they already know what to do.

Section II: Research Question No. 2

Section II presents the results of the interview questions that addressed the second research question: How has the impact of technology affected the MSHP's organizational work practices prior to and following the implementation of their new tasks, and how do they perceive their new position in terms of incentive structure, wage, autonomy/authority, task difficulty?

The question was analyzed across modalities (i.e, non-specific to one type of imaging technology) and took into account responses from all thirty-three interviewees. The analysis sought to establish similarities and dissimilarities with regards to training for pre and post imaging modality implementation; (explorative section; question (#1 and 2), structural incentives: (explorative section; question #4), wage discrepancies before, during, and after achieving imaging competency; (explorative section; question #5), perceptions of successful competency completion and issues of authority and autonomy; (explorative section; question #6); and perceptions of difficulty/responsibility levels with new assigned tasks and comparability to negotiated wages (explorative section; questions # 8).
Analysis of Training for Pre/Post Imaging Modality Implementation

The results regarding the training prior to and/or following the implementation of a new imaging area varied somewhat by the experience of the individual assigned to the area and the technological sophistication of that particular modality.

Half of the respondents indicated that in order to implement new modalities and "get the system up and running in a timely manner," technologists were initially hired from other facilities who were completely trained. They, in turn, were expected to train others. In 20% of those cases, the experienced technologists were retrained by the manufacturers' application specialists. Nearly one-third (32%) of the respondents indicated that following the purchase of the new technology, hospitals recruited technologists from the diagnostic area and gave them some form of on-the-job training.

A significant minority of the respondents (18%) indicated that the imaging suite was already well established by the time they first began working in the imaging suite. Therefore, they had no knowledge of the training practices that existed in regards to implementing the new technology.

Overall, in regards to their own training as a MSHP, eighty percent (80%) of the interviewees reported that they were initially trained on-the-job. The other 20% reported re-training by an applications specialist or were sent to another facility for a short period of time in order to gain "hands-on" experience. For the majority of the modalities on-the-job training was sufficient especially when used in conjunction with other competency based assessment instruments. Retraining was only an option for the more sophisticated technologies such as ultrasound.
Analysis of Structural Incentives

The most frequently reported incentive reported by 42% of the respondents was a "step increase." Such an increase involved a move up the vertical hierarchical organizational structure. For example, it is comparable to an Imaging specialist I moving to a Imaging specialist II. Such step increases involved a 5% increase in pay.

Another 24% of the interviewees reported that being given the opportunity to learn a new modality was incentive in itself. In the process of becoming multiskilled, 8% saw the opportunity to learn a new modality as providing "job security". A handful of the respondents were promised a "more flexible work schedule" as a result of becoming MSHPs, including call-back (8%). Management promised 8% that, following a successful training period, they would not only pay their advanced level certification examination fees (8%) but also provide them with an opportunity to train others (4%).

For 2%, the incentives were personal, or related to a physician with whom they worked. They were self-motivated to become MSHPs or they were motivated by a radiologist who took particular interest in their abilities and encouraged them to become multiskilled.

Analysis of Wage Comparison

The most commonly reported (58%) change in earnings following training to be a MSHP was a 5% increase which correlated with the step increase. No change in earnings were reported by 34% of the interviewees. In these cases non-monetary incentives were provided such that the provision of training opportunities being provided greater flexibility in work schedule, or the chance to train others. Another 8% reported less than
a 5% increase following training that ranged anywhere from 30 cents/hour to $2.00/hour. Even though the majority of the MSHPs were given a 5% increase in pay, following competency completion there was a small group 8% who reported earning less than 5%. This was reflective of the way that management discriminated earnings among the various modalities. For instance, Interviewee #1 at Hospital #3 reported that CT technologists were given more money than the mammography technologists to work in that area. Additionally, the same individual reported that CT technologists were paid overtime but if a mammography technologist had to work overtime they were given release time.

Those reporting no change in earnings (34%) were new student graduates who were offered the "opportunity to train in a new modality" without being provided a monetary incentive.

Analyisis of Competency Perceptions and Autonomy/Authority

Most of the MSHPs (62%) believed that the 6 month to one year training period they were given was sufficient in order to obtain competence. The rest of the respondents reported that they had a 2 month to 5 month training period. Length of training was dependent on the type of training, use of competency based assessment and frequency of assignment within the imaging area. Although the majority of respondents believed that a 6 month to 1 year training period was adequate to achieve competency, there was a greater sense of autonomy but no greater authority in the imaging suites than in the diagnostic area. Those individuals reporting the same amount of autonomy were new trainees who were under direct supervision during a procedure. Either trained or not, in
all cases authority within the suite did not change and continued to be traditionally held by the designated radiologist.

The MSHPs described their own perceptions of having complete competency in the following terms: having enough confidence to perform a variety of procedures on a variety of patients, without supervision or while on call. Such a description was given by 90% of the respondents.

Only 5% of the respondents suggested that they derived a sense of competency as a result of having completed competency checklists under the supervision of an experienced technologist. Positive feedback by the radiologist(s) provided an indication that the MSHP had finally achieved competency (4%). Only 1% did not achieve an adequate level of competency in the area due to the failure of management to maintain a regular schedule for the trainee within the imaging area.

Another effect of advanced technologies suggested by the data was the amount of autonomy and the change in the lines of authority reported among the multi-skilled technologists in comparison to the general radiography area. Each modality became their own specialized sub-unit. Within each sub-unit there was one supervisor or senior-imaging specialist who supervised the other employees. The mammographers, CT technologists, cardiovascular/interventional technologists and sonographers set operating procedures for their areas, ordered their own supplies, scheduled their own patients, and kept their own records and inventories. A unanimous 100% of the sample stated that their new tasks required greater responsibility and entailed greater difficulty. Additionally, the imaging technologists could set their own pace at work by having control over
scheduling. This was important due to the unforeseen equipment contingencies and the needs of the radiologists. Since the administrators had no knowledge of the new modalities, the technologists checked their own films and received feedback only from the radiologists. Due to this structural arrangement and more specialized tasks, 94% of the respondents expressed greater autonomy within the imaging suites. Only 6% stated that there was no change in autonomy primarily because they were new trainees and still under the close supervision of the senior imaging specialists and the radiologist. For example, when asked about the changes in autonomy Interviewee #2 at Hospital #5 stated: I am still being trained for this area (CT) so I really can not answer this question. I still rely on the other technologists and the radiologist a lot.

In comparison, the general radiography area was staffed with a chief technologist who supervised the department's daily activities and a manager whose primary concern is with productivity, efficiency, and issues of accountability. All tasks and procedures within general area were largely scripted by the chief technologist and department manager. (see Figure 1, page 82) shows a graphic representation of the lines of authority for the general area compared to the imaging areas.
FIGURE 1

GRAPHIC REPRESENTATION OF LINES OF AUTHORITY IN A RADIOMETRY DEPARTMENT

GENERAL (DIAGNOSTIC)

ADMINISTRATORS (ADM)
(MANAGEMENT)

RADIOLOGISTS (RAD)

X-RAY TECHS (XR)

IMAGING AREAS

ADMINISTRATION (ADM)
(MANAGEMENT)

RADIOLOGISTS (RAD)

CT TECHS

MAMMO TECHS

CVIT TECHS

ULTRASOUND TECHS
Overall, 94% of the sample experienced greater autonomy in that they were able to do "a lot more" without the radiologist than in the diagnostic area but did not feel they had any greater authority. Still 6% reported being able to "do about the same" without the radiologist present and agreed that there was no change in their authority within the imaging suite as compared to the diagnostic area. No respondents stated that they were able to do less without the radiologist present unless they were in training.

**Analysis of Task Difficulty/Responsibility with Wage Commensuration**

100% of the respondents stated that their new tasks required greater responsibility and entailed greater difficulty. The overwhelming majority (99%) also reported that their new earnings or negotiated non-monetary incentives were not commensurate with their new role. The only individual who said that their earnings were commensurate was a technologist who had moved from an administrative position to an Imaging specialist position without a resultant decrease in pay.

**Summary**

The data suggest that the most common rationale used by management for initial imaging training and implementation was to hire an individual outside of the hospital with inherent expertise and then train other technologists from within the department. If they did not hire an individual from outside the department, technologists were trained by an application specialist or sent to another facility for training and then appointed to train others. However, the majority of the respondents (80%) in this study had not been a part of the original implementation and training phase. They had received their training on-the-job. This could reflect the growing number of MSHP's across modalities at the
various hospitals included in this study. It could also be due to Tucson’s growing population and to an increasing demand for physicians’ requested examinations.

There were a plethora of reasons given regarding structural incentives. It is apparent that the greatest incentive was the ability for the technologist to move up the vertical hierarchical structure which resulted in a 5% increase in pay. Other incentives that respondents identified were the chance to become multiskilled, the opportunity to obtain a more flexible work schedule (to counter set taking call), an opportunity to train others and an assurance of job security.

Lastly, all MSHPs expressed a greater sense of difficulty and responsibility with their new assigned tasks than in the diagnostic area. Caught between management and radiologists the paraprofessional was plagued with problem solving equipment malfunction, forced to gain a broader knowledge base which included passing an additional certification examination, working erratic hours and forced to "baby-sit" new trainees. As a result, 99% of the sample stated that their new tasks were not commensurate with either their new wage increase or negotiated non-monetary incentives. There was one reported case of gender based wage inequality. Interviewee #2 at Hospital #1, stated that she had to fight for 75% of the raise given to males in the same position. She was further instructed that employees were not to discuss wage issues with other employees.

**Discussion of Research Question #2**

The final sample of multiskilled technologists included mammographers, CT technologists, cardiovascular/interventional technologists and sonographers. Barley
(1990) mentions that one of the first effects of advancing technologies is a macrosocial, institutionalized practice and implementation of an incentive structure. An incentive structure existed at all eight hospitals chosen for this study. At each institution, the use of an incentive structure was only available to the multi-skilled technologist and not the general diagnostic radiographer. This type of practice could lead one to surmise that at each institution, management valued the newer modalities more highly than the general areas. One explanation for the common occurrence of incentive structures for multiskilled health care workers can be found in mimetic isomorphism (DiMaggio & Powell, 1983). In mimetic isomorphism institutional practices are initiated by institutions for operational improvements. Additionally, the increased difficulty and responsibility reported by 88% of the respondents coupled with working weekends, rotating shifts, and spending evenings on call justified its existence. According to the data, incentive structures included both monetary and non-monetary components. The monetary incentives that were placed included a 5% increase for each modality mastered beyond general diagnostic duties. This correlates with the vertical structural hierarchy as shown in (see Table 2, page 47), and reported by 42% of the respondents.

Other monetary incentives that did not follow a 5% increase ranged from 30 cents per hour to $2.00 per hour and were reported by 8%. The largest non-monetary incentive reported by our sample was the opportunity to become multi-skilled (24%). Other non-monetary incentives for becoming multi-skilled included job security (8%), flexibility of work schedule (8%), assurance of paid examination fees (4%), and an opportunity to train others following competency (4%). Micro-social institutional practices (Barley, 1990),
such as self motivation or motivation by significant others, accounted for 4%. It is interesting to note that the non-monetary incentives were provided to new employees (i.e., student graduates) whereas the monetary incentives were reserved for senior technologists.

At two of the hospitals there were wage discriminations noted between modalities. For instance at Hospital #3, the CT technologists were paid time and a half for overtime, whereas the mammographers at the same institution were given release time instead of overtime pay. Not only did management value the newer modalities but following the concept of criticality one could assume that management may have held one modality higher than the others within their institution. At Hospital #1 we have evidence for wage discrimination based on gender. Interviewee #2 states: When I became a supervisor, I had to fight for a raise and only received 75% of the raise that the male employees received with their supervisory position. I feel I had more responsibilities than some of the male supervisors and should have received the same raise. That was over five years under different management. I would hope that has changed. However, we are asked not to discuss salaries, so it is hard to judge.

With regards to skill development, there were three broad skills identifiable from the data: interpretive, troubleshooting equipment malfunctions, and improvisation. The same three broad skills were identified by Scarsaletta in a 1993 study that explored Medical Technicians' work.

The primary aspect of the imaging technologists skill is what Scarsaletta referred to as "the interpretive part of what they do." Basically, interpretive skill is the process by which
technologists look at the procedure in the context of technical and formal knowledge, tacit and working knowledge, and knowledge of the individual patient's history (age, gender, suspected diagnosis, etc.) in which to make sense out of anomalous findings. For example, Interviewee #2 at Hospital #2, described it as follows: The radiologist may know what they want - but do not always know how to get it. Some doctors ask my opinion of the films-others would never. We do often take films at our discretion trying to get the "right" view without the radiologists direction. The doctors do depend on our positioning skill for manipulating the breasts in order to see lesions.

A second broad skill for overcoming the sources of error during a procedure was the ability to troubleshoot machine malfunction. Machine troubleshooting was the process of developing intimate knowledge of the machines inner workings in order to diagnose errors. Technologists who were best at troubleshooting had fashioned a remarkable ability to "home in" on machine problems by using a combination of sight, sound, and technical know-how (Scarsaletta, 1993). Since exam results depend on the speedy delivery of information by the scanner or equipment at hand, breakdowns were viewed by the technologists as no small matter. Additionally, physicians require around the clock results especially for the traumatically injured, so it seemed that the technicians work did not stop for machine malfunction. Since technical malfunctions had such a dramatic implication for the work of the imaging specialist, those who were able to remedy the situation were given "skilled status". Interviewee # 2 at Hospital #2 described his experience as a night CT technologist as follows: I feel I am more valuable than other technologists in this area. At night when you are the only technologist on call you are
expected to be a problem solver especially when the machine "acts up". You need to be able to overcome the simple obstacles in order to keep the area running. I do not think the day technologists have the same abilities.

The last broad category of skill suggested by the data was what Scarsaletta identified as improvisation and artistry, specifically the ability to develop on-the-spot techniques for controlling unexpected variables during a procedure. The multi-skilled respondents viewed improvisation as a relatively fixed characteristic of individuals in the imaging area. It appeared to account for a primary tactile component of skill possessed by only the finest imaging specialists. As one multi-skilled technologist explained: There's a certain feel that the best technologists have, and really, it's a talent. They just seem to be blessed with the ability to see through a scan or procedural obstacles. I've seen very well educated, capable technologists in an imaging area who just never develop that feel no matter how long they've been working. And they probably never will: it seems you either have it or not.

Section III: Research Question No. 3

Section III is designed to describe the results of the interview that addressed the situation of the MSHP in terms of the enskilling/deskilling debate (summative section, question #1) structured around the third research question: Overall, what positive and negative feelings do you hold about your new role and assigned tasks as a MSHP? What changes would you suggest to improve your new position?

There are two parts to this analysis. The first part presents the responses for the Tucson metropolitan respondents in general. The second part presents an analysis of the
data for each hospital subgroup of MSHPs. The phenomenon of enskilling and deskilling is embedded in the cultural and workplace environs. Thus, it makes sense to consider variations by type of setting. For each hospital subgroup, patterns of similarities and dissimilarities irrespective of modality (all are considered advanced technologies) are considered in order to determine the extent of which there is enskilling and deskilling.

**Part I: Tucson Metropolitan Multiskilled Health Professions (General)**

The analysis presented here will show that the group of MSHP respondents had both positive and negative perceptions about their new role and tasks. In light of enskilling and deskilling, their perceptions illustrate elements of both theories. Important recommendations follow for improving their existing place in a changing workplace environ.

**Analysis of Positive Perceptions**

The positive perceptions expressed by the interviewees about their new role and assigned tasks included being: "challenged" by the involvement of a vast array of new procedures with technologically advanced equipment and supplies requiring a greater knowledge base (36%); a "greater self worth" described by the MSHP as possessing multi-modality capabilities providing greater human capital within the radiology department (32%); "more job security" defined as less likely to lose their position during times of institutional restructuring due to the increased demand for multiskilled health care workers (20%); "empowered" by having greater autonomy in procedural decision making practices within the imaging areas (8%); and an opportunity to train in imaging areas that are considered a "privilege" by management (4%).
The negative perceptions offered by the MSHP respondent in regards to their new role and assigned tasks were described as inadequate training and/or availability of advanced imaging educational programs in the Tucson metro area to confidently perform the full scope of required tasks (42%); "greater difficulty and responsibility" in having to operate and problem solve highly specialized equipment and supplies (40%); "greater dependence" on the MSHP by the radiologist(s) to successfully perform procedures in a timely fashion (12%); "discriminative management control" in scheduling and assigning training opportunities to other technologists (4%); and "less cooperative team effort" in the general diagnostic area due to the relative willingness of "some" trained and competent MSHPs to share responsibility for the "less important task" (2%).

In response to what changes the MSHP would suggest to improve their new position included placement of a full time compliment of trained MSHPs within each imaging area to allow for a higher standard of performance and additional time to complete secondary (clerical) responsibilities (42%); a greater allowance of professional development monies to maintain or acquire higher skill levels in preparation for advanced level certification examinations by participation in seminars, conferences, workshops, correspondence courses and training programs (40%); Interview #1 Hospital #1 stated: I feel I could be doing a lot better job if I was over here all the time. I like the responsibility. I do think they spread us too thin to the point that we can’t maintain a higher level one week a month. I am not sure if that’s management. I think things would be a lot better if we were full-time in CT, had even newer equipment, were sent to more seminars for training and they provided incentives for continuing our education in CT.
Lastly, a pay increase of 10-20% to adequately compensate for the demands of the job and an increase in skill requirements (18%) illustrated by the following excerpt: Interview #3 Hospital #2: Raises should be 10-20% more. The current 5% increase between steps doesn’t seem enough to compensate for time spent to learn a new modality.

**Part II: Subgroup Analysis**

**Hospital #1**

The subgroup of MSHP technologists at this hospital expressed positive perceptions that included a greater versatility of tasks (described as more responsibility by 66%), greater self-worth, more respect and job security (33%). However, they also identified many negative feelings. These included an inability to maintain a high standard performance due to part time scheduling (66%), and "burn-out" (33%) from taking call. Interviewee #3 Hospital #1, illustrated this point by saying, One of the negative feelings of being a mammo tech is that the burn-out rate rises the more time you spend in the modality.

All of the respondents (100%) recommended a full time compliment of technologists within each modality in order to raise the standard of performance. Interviewee #3 Hospital #5 is just one of many who stated. The work is demanding, because there are only two CT Scanners and it seems like everybody wants a CT scan now, so it is a very fast paced job. A full staff of CT techs would be very helpful.

**Hospital #2**

Fifty percent of the subgroup at this facility felt empowered and challenged with their new role and tasks. Twenty-five percent possessed a greater self worth and described their
new role as providing them with greater opportunities and diversity of assigned tasks. Schedule flexibility and job security were reported by 25%.

Negative feelings reported among this group included the control of management over scheduling and decision making for who would be next for training (50%). The technologists felt it was unfair for the radiologist(s) to assume that all technologists within the imaging suite functioned at the same level of expertise (25%). A lack of cooperative team effort was mentioned and described as an unwillingness of the trained MSHPs to perform general diagnostic duties (25%).

Recommendations by this subgroup included that scheduling and training decisions be left up to the imaging supervisors and not management (50%). Additionally, a pay increase of 10%-20% should be implemented to adequately compensate for their additional responsibilities.

Hospital #3

Interview #2 and #3 of this hospital do a nice job of illustrating the general consensus for this group by saying, As a MSHP, I like the challenge that it provides, the satisfaction it brings about, and the opportunity to advance as a radiologic technologist, I feel good about myself and my achievements. Rewarding and challenging opportunities were used to describe the positive perceptions for this group of technologists (66%). Increased job satisfaction and greater self worth were revealed by 33%.

Negative perceptions included wage discrimination among different modalities at this institution, especially following competency completion and for overtime pay (66%). The call back schedule created stress for a few individuals of this subgroup when they were
unexpectedly asked to fill in for another technologist (33%) because of their higher level of expertise and seniority. One of the mammography technologists from this group shares these views by stating, Right now I do this every other day and Susan and I are partly responsible for catching an early breast carcinoma - that can be very stressful. You know, I'm upset that the CT techs got a raise and were up to a Imaging Specialist II Level. They spoil the CT techs The ultrasound techs also got a raise. Both of them get flex time, like for CT, every 8 hour shift that they work over they get one hour of time off. Whereas, the ultrasound techs, just get 2/3 of an hour for the same 8 hour shift of overtime. In mammo, we didn't even get a raise!

Part of the subgroup recommended that each modality be given the same increase in pay following training and the same overtime compensation across modalities (66%). The other segment recommended a structured call back schedule that included all trained individuals more equally (33%).

Hospital #4

There was a unanimous sense of empowerment among the technologists at this health care facility. MSHPs indicated that they felt a sense of importance. They also felt challenged, and excited about their new positions (100%).

There were only two individuals who expressed negative feelings in that they believed that felt that there should be more monetary compensation for their new responsibilities. For example, Interview #3 stated, I love my position! I find it exciting and challenging. However, I do feel I should be better compensated for the extra work I do. I feel people should be rewarded for striving to be the best.
Not one technologist of this subgroup made any recommendations for improvement.

Hospital #5

In this setting, (33%) of the imaging specialists described their new role and assigned tasks as stimulating and challenging. (66%) indicated greater job satisfaction, and that they had a provisional sense of marketability, and of acquiring a greater knowledge base. One new trainee expressed a general sense of satisfaction in working with others in the imaging area by saying, The people are incredible to work with and they make learning fun.

However, there were also some negative perceptions at this site. There was some unhappiness about working different shifts at the "whim" of those who work in CT all the time 33%. Also, (66%) believed that there was inadequate pay compensation for the demands and stress of the job.

Only one individual brought forth a recommendation that: a full staff of CT techs, would be very helpful.

Hospital #6

At this hospital, 100% of the interviewees felt challenged and excited about their new role and position within the imaging area. There was a greater sense of responsibility and difficulty in handling the equipment.

Negative feelings included that only a slight 5% increase in pay was given for possessing multi-modality capabilities and they thought this should be increased 66%. The on-the-job training that was provided to each of these technologists focused primarily on equipment and supplies and did not adequately provide for anatomical considerations
during scanning. Therefore there was no change in autonomy from the general area to the imaging suite as there was the same reliance on the radiologist to successfully complete the procedures 33%.

Recommendations included a pay increase commensurate with their new responsibilities 66%. For new trainees 33% recommended that in conjunction with their clinical internship, a formal educational program would be useful to adequately provide them with the skills needed to meet the changing health care workplace.

Hospital #7

The entire group of respondents at this facility were sonographers. All other imaging areas were staffed with full-time imaging specialists. The respondents were unanimous in feeling that their new role and tasks were challenging. They felt a strong sense of empowerment particularly with the responsibility of being asked to image and record specific visceral and vascular structures using sound wave transmission.

Negative feelings expressed by the group included an inadequacy of training provided by the hospital 75% and an inadequacy of pay commensurate with the demands and pace of the job 25%.

Recommendations by the group included being sent to a formal educational training program coupled with clinical internship and eventual RDMS advanced level certification 100%.

Hospital #8

Only positive perceptions were given by this subgroup of MSHPs. Greater team effort was reported by 75% of the technologists at this facility. Challenged, empowered and
having a greater versatility of tasks were provided by the other 25% interviewees.

There were no negative feelings brought forth by this subgroup. However, 100% of the respondents recommended a non-specified increase in pay for all technologists across modalities.

**Summary**

Before there is an attempt to summarize the data across hospitals for the third research question, we must first re-establish what is meant by enskilling and deskilling. For this study, if the MSHP radiologic technologist expresses empowerment, a sense of greater opportunities, and experience versatile tasks within the imaging area, with less managerial control, then this is evidence of enskilling. On the other hand, if the health care worker experiences greater routinization of tasks, less opportunity and versatility of tasks and possess less autonomy with more managerial control than deskilling is preeminent.

If we look at the data in general for the Tucson metro MSHP's and look at the percentage of enskilling and deskilling elements reported by our sample, we could specifically say the following. The positive perceptions which only account for 48% of the data reported included the following elements of enskilling; challenged 36%, empowered 8%, and greater opportunities 4%. Not included in this question, but reported in Section I was a greater sense of autonomy in the imaging area and a more positive interaction with the radiologist. The only element of deskilling that surfaces under negative perceptions is discriminative management practices (control) that only accounted for 4%. Based on this analysis enskilling is predominant for our sample of
Tucson multiskilled radiologic technologists.

In order to establish the presence of enskilling and deskilling for each hospital subgroup, (see Table 3, page 98), compares identifiable elements of enskilling and deskilling for each hospital subgroup based on percentages reported. Based on that comparison, the following conclusions can be made. For Hospital #2, #4, #5, #6, #7, and #8 enskilling is evident. For Hospital #1, #3 deskilling is apparent.
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<th>ELEMENTS</th>
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Discussion of Research Question #3

To test a theory of technology’s impact on a division of labor ideally requires diachronic and ideographic data on the technology’s use across a variety of settings and across time (Barley, 1986a). Such data are crucial for determining how acts and interpretations shape the technology’s social ramifications. This study provides data from various settings. But, it is primarily synchronic in nature. It represents a cross-section of time rather than a longitudinal analysis even though respondents did speak, to conditions of work in the past. Nevertheless, the data reveal three contextual factors that condition social action and thereby affect a technology’s tendency to empower or degrade its users: 1) semiotic properties of the technology, 2) incremental technology introduction; and, 3) attributes of the larger socioeconomic environment.

In order to be a imaging specialist, the individual must be able to read meaning where a novice might misinterpret a message or see no message at all. Such interpretive expertise is considered a semiotic property of technology. One example of a code producing technology is advanced medical imaging equipment. In this case, the technology generates symbols, sounds or images that are presumed to reflect the condition of the human body. The increasing prevalence of code producing technologies has led some observers to herald the dawn of an “information society” (Bell 1979). The degree to which a code producing technology empowers its users depends on the code’s semantic and syntactical complexity, the importance of the information that the code carries, and the degree to which interpretive acumen remains scarce.

Of all the imaging specialists within the radiology department none have higher status
or more influence than the sonographer (Barley 1984). For example, unlike x-ray technologists, sonographers schedule their own patients, make decisions about the course of an exam, and routinely discuss the patient's pathology with both radiologists and referring physicians. The sonographers status and discretion are tied to the ultrasound images. The scans are difficult to interpret and in order to successfully complete an examination, the sonographer must be able to read the images as well as the radiologist. Historically, radiology's professional dominance grew out of the specialty's ability to monopolize the interpretation of medical images (Larkin 1978).

To the degree that ultrasound and other computerized imaging devices have altered the traditional distribution of interpretive expertise they have made radiology's interpretive monopoly more difficult to maintain. The result has been to empower the sonographers and other technicians who operate the new technologies (Barley 1986b). All interviewees at Hospital #7 consisted of a group of sonographers. Their responses indicated that they felt that their new role and tasks were challenging and as a result experienced a strong sense of empowerment.

Just as technological innovations can be described relative to their departure from past practice, so too can the introductions of technology, the process by which firms implement new technologies. Incremental introductions entail a strategy of piecemenal organizational change: the technology is slowly, implemented on a person-to-person basis. When technologies are implemented slowly their effects are initially limited to a small number of people. If these users represent but a small proportion of an occupation's members (as is the case within imaging areas) then any shift in the occupation's
demographic base of power is likely to be trivial. Additionally, workers are better positioned to define a technology's use when it is introduced incrementally. Because incremental introductions affect but a handful of individuals, they pose little immediate threat to existing work cultures. Cultural shaping should play an important role in determining the technology's use, since the occupation will have more time to construct a shared understanding of the technology's meaning or the firm's intentions. Although there have been no comparative studies of the implications of incremental introductions for the distribution of power (Barley 1988), the data from this study point to such a finding.

Training for pre and post imaging implementation was primarily on a person-to-person basis. Moreover, despite the fact that respondents believed that technology enhanced their autonomy within the imaging area, they also believed that the authority structure remained relatively constant.

Just as technology's implications for work are conditioned by the organizational and occupational milieu in which it is deployed, so the organizational and occupational actions are in turn shaped by the larger socioeconomic environment (Barley 1988). Economic trends and social conditions can facilitate or hinder a firm's capacity to degrade work as well as occupation's ability to enhance, retain, or exercise power. Adequate theories of technology and work must therefore eventually look beyond the immediacy of the technology and the specifics of the work setting to consider socioeconomic trends.

Firms are unlikely to employ technologies to degrade work unless the strategy makes economic sense. Whether the degradation of work proves profitable depends, in part, on the firm's product market. The implementation of expensive advanced imaging medical
equipment can spell financial ruin unless the demand is sufficiently large to support the presence of the equipment. If we re-examine the data provided by this study on the changes in the number of technologists within the imaging area and the differences of a part-time compared to full-time availability of multiskilled workers, we can draw the following conclusions with regards to socioeconomic trends:

1. the smaller the hospital (< 200 beds) the more likely the imaging areas will be staffed with a part-time compliment of imaging technologists and the more likely the number of personnel assigned to each area will fluctuate dependent upon the number of examinations requested. This approach is financially more feasible for smaller hospitals.

2. the larger the hospital (> 200 beds) the more likely the imaging areas will be staffed with a full-time compliment of imaging technologists and the more likely the number of personnel assigned to each area will remain the same.

The firm's capacity to degrade work is most evident in the smaller hospitals. That is, as the numbers of workers fluctuate (decreases) within a given imaging area, the greater the work load for the technologists who remain. By contrast, in the larger hospital environment a full time compliment of imaging specialists continue to "share-the-load" with only minor changes in the number of requested examinations over time. Certainly one recommendation for smaller hospital practices would be to maintain an economically feasible number of full-time imaging specialists (based on an average tech. to patient ratio), within each imaging suite. This strategy would keep the workload in balance and not add to work degradation. Secondly, if a full-time compliment of imaging specialists is not feasible, then management should assign the same group to general diagnostic duties during slow times.
Section IV: Research Question No. 4

Section IV presents the results of the interview questions that addressed the fourth research question. In what ways did the MSHP’s formal education provide or not provide the skills needed to perform their new tasks?

Skill is a highly contextual phenomenon. What constitutes a skilled performance in one imaging area does not necessarily resemble skill in another area. Therefore, the attributes and deficiencies of the MSHP’s formal education will vary from one modality to another. Also, not every MSHP received their education from Tucson metropolititation educational programs. Therefore, attributes and deficiencies noted by the respondents are not generalizable for all Radiologic Technology programs in the Tucson area. Before attempting to analyze the results, it would be useful to give the reader a sense of the technologist’s role within each modality. I will then discuss attributes and deficiencies identified by each sub sample of MSHP.

Role of the Computerized Tomography Technologist

The primary duties of a CT scan technologist involve the use of computers to reconstruct a focused image or tomographic "slice" of the body for the diagnosis and interpretation of disease by a radiologist. Therefore, the CT technologist needs to be skilled in three dimensional anatomy, patho-physiology, computerized image manipulation/reconstruction and possess the ability to problem solve. Due to the anxieties and fears that may engulf a patient in a close knit "donut-shaped" gantry, the MSHP in
this area must be well versed in patient monitoring, drug/contrast administration and medical emergency protocol.

**Analysis**

CT technologists represented 40% of the sample of MSHPs. These MSHPs described their formal educational program attributes as including: an optional rotation in CT during their final semester of training (60%), anatomy and physiology coursework either taken as prerequisites for program admission or required by the program curricula (20%), and courses taken to enhance patient care skills (10%)

In reference to their formal educational program, CT technologists identified the following deficiencies as possessing a lack of computer science courses and 3-D sectional anatomy presented in sagittal, coronal and transverse planes (90%).

Ten percent of the sub sample felt that radiologic technology programs should not be responsible for providing coursework aimed at providing specific skills for advanced imaging modalities. Instead colleges and schools should provide separate facilities for the training of the imaging specialist.

**Role of the Mammography Technologist**

The primary duties of a mammographer include the use of a "dedicated film screen mammography unit," specialized equipment and supplies in order to produce high quality images for the early detection of breast cancer. Necessary skills include a working knowledge of positioning integrated with anatomy and pathophysiology of the breast, a complete understanding of the physics and capabilities of the mammography unit and a unique blend of patient care skills to combat the general anxieties and fears of the clients.
regarding breast cancer. With the advent of the MQSA (Mammography Quality Standards Act) in 1994, an intensive quality control regime is required for all mammography facilities by the ACR (American College of Radiology). Each mammography facility must demonstrate certain standards on an annual basis in order to maintain accreditation. Therefore in addition to their regular duties, the MSHP must be capable of maintaining a daily quality control program. This may include film desitometry/ sensitometry, re-take analysis, and processor chemistry and instrumentation maintenance.

Analysis

Mammographers represented 40% of the MSHP sample. These MSHP described their formal educational program attributes to include an optional rotation in mammography which was provided in their final semester of training (30%), a brief introduction and general mammography overview provided as part of a unit (30%), and courses in radiologic physics and anatomy (40%).

In reference to their formal educational programs, mammographers identified the following deficiencies as possessing a lack of routine/advanced mammographic positioning 80%; and lack of pathophysiology of the breast 20%.

Role of the Cardiovascular Technologist

Technologists working in this area are involved in performing radiologic examinations of the heart and great vessels. These procedures involve the injection of contrast material via special catheters directly into vascular structures for the diagnosis of disease. A variety of interventional procedures such as stenting, angioplasty and embolization are performed for therapeutic purposes following initial diagnosis.
Technologists in these areas are involved in the use of highly specialized equipment, supplies, and advanced procedural protocol. Patient monitoring, drug/contrast administration, ekg interpretation, emergency medical procedures and a thorough working knowledge of vascular anatomy are just a few of the mandatory skills.

Analysis

CVIT technologists represented 20% of the sample of MSPHs. These MSHPs described their formal educational program as having the following attributes which included an optional rotation in CV was provided in the final semester of training (60%), a brief introduction and general overview of CT provided as part of a unit (25%), and courses in anatomy and patient care skills (15%).

In reference to their formal educational programs, CVIT technologists identified the following deficiencies as possessing a lack of EKG interpretation and patho-physiology (40%), and no other differences noted (60%).

Role of the Ultrasound Technologist

Ultrasonographers are directly involved in the visualization of structures of the body by recording the reflections of high frequency sound waves directed into the body's tissue and organs. As the sound waves "bounce" off the area of interest, special equipment is then used to reconstruct and record the image. The sonographer must possess a through working knowledge of the physics of sound transmission through various densities of the body. Sectional (3-D) anatomy of the body, pathophysiology and good patient care skills are of crucial value to this technologist.
Analysis

Ultrasonographers represented 12% of the sample of MSHPs. The sonographers described their formal educational programs as having the following attributes which included an optional rotation in ultrasound was provided in the final semester of training (75%); and courses in basic anatomy and physics (25%). The only deficiencies of their formal educational programs cited by this subsample was a lack of sectional (3-D) anatomy in transverse, coronal, and sagittal places (100%).

Role of the Nuclear Medicine Technologist

The branch of radiologic technology that involves procedures that require the use of radioactive materials for diagnostic or therapeutic purposes is nuclear medicine technology. Nuclear medicine technologists are involved in the imaging of a patient's organs after the introduction of a radioactive material known as a "radiopharmaceutical". Skills required for this area include positioning, physics of radioactive materials and equipment, radiopharmaceutical dose administration and calculations, patient care considerations and sectional anatomy.

Analysis

Unfortunately, there were no nuclear medicine technologists from the MSHP interviewees that fit the operational definition for this study. Due to the demand and short supply, technologists working in this area spend 100% of their time in this modality and were excluded from this study.
Role of the Magnetic Resonance Technologist

The primary duties of the technologists in this area involve the use of a strong magnetic field and radio waves with a computer to generate sectional images of patient anatomy. Like CT, this advanced technology uses highly specialized equipment and requires an incredible knowledge of physics, sectional (3-D) anatomy and pathophysiology, drug/contrast administration, emergency medical procedures and critical thinking skills.

Analysis

Much like nuclear medicine, there were no MRI technologists from the MSHP interviewees that fit the operational definition for this study. This area of the Radiology Department was staffed with full time MSHPs.

Summary

The imaging areas staffed with the greatest number of MSHPs who work in general diagnostic radiography and "float" into other modalities were CT (40%) and mammography (40%) followed by cardiovascular interventional (20%) and ultrasound (12%). These percentages are reflective of MSHPs who were trained in more than one modality (i.e, Magnetic Resonance Imaging and Nuclear Medicine). Those areas with the most advanced technologies (i.e, MRI and Nuclear Medicine), and specialized equipment were most likely to be staffed with full time technologists.

The vast majority of the respondents (90%) felt that aside from one or two courses, their formal educational program did not adequately provide them with the necessary
skills to perform their new roles. If some coursework was seen as useful, there were also significant course deficiencies.

Another 10% of the respondents did not feel that general radiologic technology programs should be responsible for providing advanced imaging training. However, this same group of respondents did feel that these same programs should be involved in developing a continuing education program aimed at retraining post graduates. In other words, they believed that formal educational institutions should take on a larger role in providing non-degree continuing education to employed graduates.

Discussion of Research Question #4

At the turn of the century, as health specialty groups received general recognition and acceptance more formalized and specific training was required (NCAHE, 1980). The responsibility of that training, in the most part, remained with the hospitals. This lasted until the 1960's when the increasing numbers of vocational technical institutes and community colleges made it more cost effective to prepare the health care work force in an educational setting. With the advent of computerization in radiology in the 1970's, radiology witnessed a growing complexity and diversity of the skills required by the radiologic technologist, especially in the new imaging areas such as CT, ultrasound, mammography and the cardiac cath lab/interventional suites. That created a strain for many educational sites.

Most community colleges involved in training the health care workforce have Radiologic Technology Programs in place. However, their primary focus has been to prepare individuals for general diagnostic duties, not for the demands of advanced
imaging technologies. The new skill requirements require many heterogeneous health specialist educators with varying levels of knowledge and preparatory skills. Community colleges have not hired the staff and acquired the technology to fully address those needs.

Since the work force within the radiology department is diverse and complex it is difficult to understand and study it without first organizing it in some way that makes it easier to manage. Generally, these classifications are done by considering the specific skills related to the types of services that each imaging area provides and/or the educational preparation needed to perform those services.

Technology transfer in community colleges is the utilization and application in workforce preparation programs of existing technologies and new technological breakthroughs in the commercial marketplace. Technology transfer occurs when colleges assist firms in implementing technologies to operate at their full productive and competitive capacities by providing them with employees trained on these technologies. Unfortunately, the data suggest that for Tucson metropolitan MSHP radiologic technologists, their formal educational program has failed to provide an effective technology transfer program that speaks to the workforce needs of the local health care industry.

In what ways did the MSHP receive training? The interviews reveal that the imaging specialists are first retrained by an individual hired outside of the facility with inherent expertise (30%) or by the manufacturer's application specialists (20%). Following training and effective implementation of the imaging equipment, 32% of the respondents stated that select technologists were then recruited from the diagnostic area and received on-the-
job training. The on-the-job training either entailed direct supervision by the senior imaging specialist and radiologist, or the individual was required to complete the institutions' competency check-off list before being able to work independently.

The data suggest that with the advent of advancing technologies within radiology there has been a shift of responsibility for training from the community colleges back into the hands of the health care industries. In light of this finding, what recommendations can be made for the community college with regards to planning and conducting future technology transfer initiatives that would strengthen the educational preparedness of the multiskilled radiologic technologist?

1. Ensure that the internal college and system-wide administrative policies and processes support efficient and effective delivery of technology transfer including curriculum development and facilities allocation designed specifically for the needs of the MSHP.

2. Continue to strengthen partnerships with health care industries to provide technology transfer assistance. As technology transfer evolves, the community college is likely to have a growing awareness about the types of new technologies and the types of products and services they can provide via partnerships with local hospitals. This can be accomplished by providing on-the-job training or offsite training.

3. Ensure that technology transfer initiatives of community colleges are adequately funded. Well funded programs are critical in order for community colleges to maintain the necessary facilities, equipment, faculty, administration, and support services to offer discipline specific workforce preparation to private-sector small to large sized hospital firms, the public sector, and individual entrepreneurs. This could be accomplished by providing on-the-job training or off site training.

4. Continue to develop and expand the expertise of the college faculty and develop modality specific continuing education, or create a Center for the Imaging Sciences designed to facilitate the needs of the MSHP. As technology becomes increasingly complex and community colleges begin to play a more active role in technical assistance, colleges should provide intensive professional development opportunities to enhance the technical expertise of the faculty. Also, innovative
incentives are needed to involve faculty in key roles in delivering technology transfer.

5. Explore opportunities to evaluate and improve technology transfer programs through on-going formal evaluation processes. Formal program evaluation approaches are needed to determine the impact of community college technology transfer programs on local and state health care industries.
CHAPTER V: CONCLUSIONS/IMPLICATIONS FOR FURTHER RESEARCH

Relative to the consequences of advancing technologies and educational preparedness for the multiskilled health care worker a few consistent, undisputed findings are revealed. First, cultural shaping does take place in the wake of new technologies. That is, new imaging modalities can affect the social part of technology's dual nature. This finding is consistent with Stephen Barley's (1988) mention of three sources of interpretation: signaling, cultural shaping and social negotiation. In reference to cultural shaping he states that over time, members of organizations develop behavioral scripts and interpretive schemes that enable them to construct and maintain predictable environments. Furthermore, schemes and scripts act as templates that hone the rough edges off reality to yield a more familiar and comfortable definition of the situation.

Second wherever new technologies existed or were recently introduced, there is the adoption of a macrosocial institutionalized practice and implementation of an incentive structure. No other study better explains this phenomenon then Galor and Tsiddon's 1997 paper on the relationship between technological progress, wage inequality intergenerational earnings mobility, and economic growth. The paper rests on several observations that are largely supported by empirical evidence and that would account for a macrosocial-institutionalized practice of an incentive for the MSHP. They include: a.) individual earnings increase with ability, b.) major technological progress increase the relative return to ability, and: c.) the reward to ability is higher in new technologies.

Third, three contextual factors: semiotic properties of the technology, incremental technology introduction, and the attributes of the larger socioeconomic environment
condition the social action and thereby affect a technology's tendency to empower or degrade its users. Even though Barley (1988) was the first to mention the semiotic properties of a technology and its ability to enskill or deskill its user, Scarsaletta's (1994) study on medical technicians' work actually provides the missing link to this relationship. In her study she identifies the presence of interpretive skills. That is, being able to make sense out of the nature of the language. Specifically the greater the semiotic properties of the language, the greater the interpretive expertise required for the job, and the greater the effects of enskilling on the operator. Lastly, advanced imaging modalities have produced a dynamic impact on the skill requirements necessary for the multiskilled radiologic technologist by replacing some traditional craft skills with entirely new ones.

In light of cultural shaping it was apparent from the data, that the new technologies had generated a set of distinctions (i.e, role and patterns of interaction with the Radiologist) from the general diagnostic area and the more specialized imaging suites. On one hand, the general diagnostic areas were populated by technologists with comparatively less autonomy and knowledge, and characterized by bureaucratic practices conducive to conflict and tense relations. On the other hand, the special imaging areas housed a more knowledgeable, autonomous group of technologists (i.e, dubbed MSHP) where the relations between radiologists and technologists were more collegial and cooperative. If technologies influence forms of social order, they must do more than change people's instrumental acts or abilities, they must also affect the relationships on which social orders are ultimately grounded.
Explanations for macrosocial theories of technology and structure need not be classified as conservative nor Marxist in origin. Instead, institutional theorists (Meyer and Rowan, 1977; DiMaggio and Powell, 1983) can explain shifts in organizational structure. For instance, the data from this study revealed a unanimous adoption of an incentive structure for the multiskilled health care worker. Institutionalists have long argued that organizations often adopt new structures via mimesis, a process that may reflect management’s decision to signal that a firm is at the cutting edge of its industry (Tolbert and Zucker, 1983). Once in place, these new structures can shifts work roles and activities, which, in turn, can require substantial modifications for employee compensation.

One of the technical attributes of an advanced technological system such as, medical imaging devices is the ability to generate symbols, sounds, or images that reflect the current state human homeostasis. That is, they do not simply create information. Between the "system of signs" and the output information is an interpretive process that falls in the hands of the imaging specialist. The degree to which a technology empowers its users depends on the code's semantic and syntactical complexity, the importance of the information that the code carries, and the degree to which the interpretive expertise will remain scarce. The subsample of sonographers in this study is a prime example of a group greatly empowered due to an altered traditional distribution of interpretive expertise required for their imaging area. Technological innovations that marginally depart from previous practice are often termed "incremental". An incremental technology such as medical imaging equipment, creates a sense of newness for the workers especially when
the system and the information produced is poorly understood by others. Incremental technologies can thereby enskill the imaging specialist. However, as the occupation's work becomes better understood and as incremental innovations begin to rationalize the labor process, health care workers may discover their work slowly degraded. Lastly, just as technology's implications for work are conditioned by the organizational and occupational milieu in which it is deployed, so the organization's and occupation's actions are in turn constrained by the larger socioeconomic environment. Economic trends and social conditions can facilitate or hinder a firm's capacity to degrade work as well as an occupation's ability to enhance, retain, or exercise power. Therefore, one must look beyond the immediacy of the technology and the specifics of the work setting to consider socioeconomic trends.

An important element in the debate about deskillling in comparison to skill upgrading concerns the role of formal education. The data suggests that requirements for formal education with regards to the multiskilled radiologic technologist are increasing but that, simultaneously, this educational request is becoming less general and more specific in nature dependent upon the specific imaging area. The ability of educational institutions to look beyond the immediacy of general diagnostic radiologic technologists and answer industry's call for trained imaging specialists will require some planning. Relevant to this study and Tucson, Arizona it is imperative that the community college and the proprietary school who are involved in labor training conduct and plan future technology transfer initiatives. This should include a framework for state – level public policy development,
development for college – level technology transfer initiatives, and for further study of technology transfer activities.

**Implications for Practice**

Based on the findings of this study and in light of the formal educational preparedness and effects of technology on organizational work practices, certain recommendations can be made for the practice of radiologic technology. Namely, the student graduate or the diagnostic technologist thinking of becoming an imaging specialist. First of all, do not expect your formal educational program to have adequately prepared you for your new role as an MSHP. New computerized technologies in Radiology require a new level of skill requirements specific to your assigned imaging area. If you do not have any inherent expertise, expect training to be any one or combination of the following: on-the-job, through the use of a competency checklist or under the direct supervision of a senior imaging technologist for a specified time frame usually 6 months to one year. If available in your area, it is highly adviseable to seek appropriate training before entering an advanced imaging technology. Two incentives will be offered to you. If you are a student who has recently graduated, expect the non-monetary type (i.e., an opportunity to train) as your only incentive. On the other hand, if you are a diagnostic technologist and have been asked to train in an imaging suite expect the monetary type (i.e., 5% wage increase) either before, during or after achieving competency. If you come into an area with previous training expect a higher wage increase for the more highly specialized areas (i.e., Nuclear Medicine, Ultrasound, or Magnetic Resonance Imaging) where demands exceeds supply. Following competency and as you gain experience within your designated imaging area.
expect a growing sense of autonomy with no resultant change in authority. Greater expertise will be accompanied with more positive patterns of interaction with the Radiologist, greater task versatility and responsibility. As you proceed with your training it is adviseable to pay explicit attention to advanced level registry requirements as they are developed by the ARRT. Moreover, the ARRT is requiring a didactic component in correlation with a clinical internship prior to being eligible to take an advanced level registry examination. This is already in place for mammography, CT, Nuclear Medicine, and Ultrasound. Therefore, it would behoove any interested individual to seek more official training methods as they are set forth by the state and national certification boards.

**Implications for Further Research**

A few questions arise from the study that should be considered for further research. One question that arises involves the causal order of the link between technology and skill. Although some studies (Adler, 1986; Zuboff, 1988) have assumed that workplace technologies do indeed shape the contours of workers tasks, other researchers (Noble, 1984) reject this assumption seeing it as inherently tainted or ideological. Specifically, effective use of the new information technologies demands important changes in workers' functions. As a result, workers must develop greater conceptual or "intellective" skills, using a wider range of information in their work. The result and change in workers skill levels usually goes against vested organizational interests in that managers sense a growing threat to their traditional power and authority. What is unclear is which view will prevail or even whether these two approaches are fundamentally at odds. Surely, from this
study it is evident that technologies do change the context in which work is performed; and surely as a part of human culture, they are shaped by values and ideologies—especially by those who are in power. Therefore it is apparent that one important area for further research concerns the reciprocal effects of ideology and technology.

A second question concerns the link between skill and worker consciousness. Much of the literature on skill has assumed that the content of workers' jobs will powerfully shape workers' social and political attitudes. Kohn (1969) and his colleagues amply demonstrated the connection between work content and personality, but the link between skill and social consciousness remains poorly understood. For instance one aspect of this dilemma purports that by imbuing their tasks with the aura of skill and limiting potential entrants into the field, incumbents try to secure certain privileges for themselves, monopolizing social positions whose tasks require less preparation than they proclaim. On the other hand, some organizations seldom possess the breadth of market power needed to construct and maintain the "skilled" label as much. Their persistence rather is routed in the logic of the production process, rather than the actions of the workers.

It is apparent from this study that the link between skill and worker consciousness was primarily dependent on the larger institutional socio-economic environment. For example, in the smaller hospitals cross training was more common among the workers which de-emphasized the "skilled" label. Whereas, in the larger hospitals MSHPs rightfully associated their positions with a high level of skill and monopolized their new social position in the department.

A third question relates to the implications for area colleges in preparing the
workforce by revising and/or developing technology transfer programs to assist the MSHP radiologic technologist. Few formal assessments have been conducted regarding the role of community colleges in technology transfer programs in the United States. Historically, two year colleges have presumably taken the greater responsibility for technology transfer in comparison to industries. However, it is apparent from this study that the direct opposite is occurring for meeting the needs of health professionals who are involved in advanced medical imaging. From a well prepared longitudinal study one could track the development, implementation, and effectiveness of technology transfer pathways. Such models could be shared nationally to assist graduate health professionals who are directly involved in technological advancements in the health care industry.
Purpose of the Pilot Interview

A pilot study was conducted with three hospitals which were included in the population. The purpose of the pilot study was to determine the efficacy of the questions, and to determine if the data obtained could be analyzed to describe and explore the areas intended by the study. It also provided an opportunity for the interviewer to practice interviewing skills. The question from the exploratory section with regards to the formal education program of the MSHP was not included in the original pilot interview.

Pilot Interview Process

The data from the point interview were analyzed to investigate the effects of technology on organizational work practices in hospital settings. Three hospitals were randomly selected from the population. Following, an MSHP was randomly chosen from each hospital for interview from the sample of Radiologic Technologists fitting the operational definition. The MSHP interviewees included two mammography technologists and one CT technologist. The MSHP interviewees received a pilot cover letter (see Instrument #1) and the set of interview questions prior to the interview. The respondents were asked to fill out the descriptive portion of the instrument prior to the interview.
Pilot Interview Findings and Analysis

Section A: Descriptive Data: Characteristics of the Radiology Department

<table>
<thead>
<tr>
<th>Interviewee # 1</th>
<th>Interviewee # 2</th>
<th>Interviewee #3</th>
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</thead>
<tbody>
<tr>
<td>Hospital #1</td>
<td>Hospital #2</td>
<td>Hospital #3</td>
</tr>
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I. # of MSHP Identified

<table>
<thead>
<tr>
<th>#1</th>
<th>#2</th>
<th>#3</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>5</td>
<td>9</td>
</tr>
</tbody>
</table>

a. Distribution of MSHP

<table>
<thead>
<tr>
<th>MSHP Distribution</th>
<th>Hospital #1</th>
<th>Hospital #2</th>
<th>Hospital #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>All four in CT</td>
<td>2 mammo, 2 CT, 1 CVIT</td>
<td>Six CT, 2 Mammo, 1 US</td>
<td></td>
</tr>
</tbody>
</table>

b. Length of stay in imaging area

<table>
<thead>
<tr>
<th>Length of Stay</th>
<th>Hospital #1</th>
<th>Hospital #2</th>
<th>Hospital #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 years</td>
<td>8 years</td>
<td>3 years</td>
<td></td>
</tr>
</tbody>
</table>

II. # of Imaging Modalities present

<table>
<thead>
<tr>
<th># of Modalities</th>
<th>Hospital #1</th>
<th>Hospital #2</th>
<th>Hospital #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>5</td>
<td>3</td>
<td></td>
</tr>
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</table>

a. History (age) of Modality: (approximated)

<table>
<thead>
<tr>
<th>Modality</th>
<th>Hospital #1</th>
<th>Hospital #2</th>
<th>Hospital #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>#1 - 15 yrs</td>
<td>#1 - 15 yrs</td>
<td>#1 - 19 yrs</td>
</tr>
<tr>
<td></td>
<td>#2 - not known</td>
<td>#2 - not known</td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>#4 - 15-20 yrs</td>
<td>#3 - 19 yrs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#3 - 10 yrs</td>
<td>#3 - 10 yrs</td>
<td></td>
</tr>
<tr>
<td>Mammo</td>
<td>#5 - &lt;29 yrs</td>
<td>#5 - &lt;29 yrs</td>
<td>#2 - 11 yrs</td>
</tr>
<tr>
<td>CVIT</td>
<td>#5 - &lt;29 yrs</td>
<td>#5 - &lt;29 yrs</td>
<td>#2 - 11 yrs</td>
</tr>
<tr>
<td>NM</td>
<td>#1 - 15 yrs</td>
<td>#1 - 15 yrs</td>
<td>#1 - 19 yrs</td>
</tr>
</tbody>
</table>

** Cardiovascular Interventional is a comprehensive term that encompasses angiography, vascular, cardiac lab, and digital subtraction angiography.
b. total # of MSHP assigned to area

4 2 2

III. Structure

**Questions did not relate, no data obtained

Need to see Radiology Department administrative/ staffing structural plans available from the department managers.

B. Section B: Exploratory Section (Technological Effects)

The purpose of the exploratory section (which had 7 questions) was to explore how technology has impacted the MSHP's organizational work practices prior to and following implementation of their new tasks with regards to structure, wage, autonomy, and skill development.

<table>
<thead>
<tr>
<th>Interviewee #1</th>
<th>Interviewee #2</th>
<th>Interviewee #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital #1</td>
<td>Hospital #2</td>
<td>Hospital #3</td>
</tr>
</tbody>
</table>

I. Recruitment

inside department  inside department  inside department

II. Training of MSHP

on the job  on the job  on the job; retrained

IV. Incentives

financial  financial  status redefinition

motivated by Radiologist
V. Wage Comparison

before: city average
during training: no change after competency: 5% increase

before: average
during training: no change after competency: 5% increase

VI. Authority following competency

Informal neither informal

VII. Patterns of Interaction

role reversal: no documentation
communication: easier
autonomy: greater

role reversal: no documentation
communication: easier
autonomy: the same

role reversal: no documentation
communication: easier
autonomy: greater

VIII. Nature of Task Assignments:

level of difficulty: greater
level of responsibility: higher

level of difficulty: greater
level of responsibility: higher

level of difficulty: same
level of responsibility: higher
Section C. Summative:

The purpose of this section (of which there was one question) was to obtain an overall feeling from the MSHP with regards to whether the technology had reduced dependence on the employee, uprooting their skills and deepening management control, or whether the technology had relaxed the constraints imposed on human labor, promoting more innovative and participative models of workplace relations.

*lives responsibility  *feels challenged  *same managerial control
*feels spread too thin  *provided opportunities  *likes responsibility
*questions managerial control  *reimbursed for continuing education  *rewarding
*less managerial control  *feels empowered  *discrepancies with wages for other modalities

**For more specific detail with regards to this section please see the attached interview responses

Summary of Analysis for Pilot Interview

Analysis of Descriptive Section

The total number of radiographic suites in each Radiology Department (five or six) were similar in each of the hospitals. Upon review, the researcher concluded that there was no relevancy of this question to the study and therefore it will be deleted from future interviews.

The number of imaging modalities available at the institutions surveyed ranged from three to five. This was probably due to discrepancies in hospital size. As noted above, hospital #1 and #2 had a bed size greater than 300 while hospital #3 was less than 200
beds. The greater the size of the institution the more economically feasible it is to support higher technology.

Interestingly enough, there was a greater number of MSHPs in the smaller hospital than in the other two larger hospitals. The reason for this is not known; however, in smaller hospitals on the job training might be used to increase the productivity and flexibility of the workers. Additionally, this hospital did not provide monetary incentives for becoming multiskilled.

The number of years that each MSHP had spent in the imaging area varied and was not necessarily reflective of the total amount of time that the modality had been present. On future interviews this question will be modified to reflect the percentage of their time spent within this imaging area on a weekly basis. Therefore, the technologists were unable to provide the researcher with accurate data on how long each modality had been in place. This information can be obtained from the Radiology Departmental Manager and was not included in the pilot interview.

Question # 5 was designed to explore how the MSHP described their new role and their fit in the existing departmental structure. The technologists were unable to provide me with information on the administrative/staffing structure for the Radiology Department. This information can be obtained from the manager and was not included in the pilot interview. However, the two mammography technologists described their new role as one that provided them with more prestige. The CT technologist was not as positive in his response describing his new role as one that was not as genuine as in the diagnostic radiography area.
For question #6, with regards to the changes in the number of MSHP assigned to the imaging area, the two mammography technologists' responses were similar, each experiencing a reduction in number from three technologists to two. However, the CT technologist reported no change in numbers maintaining a total of four technologists assigned to that area. The number of technologists assigned to a particular modality could be reflective of the centrality of the technology to the department and could be site specific.

For question #7, responses to the changes when comparing their new role to the old were varied. The CT technologist reported a push by the doctors for advanced level CT certification. One of the mammography technologists reported a greater freedom in performing tasks than in the diagnostic area. However, she did report more difficulty in the accessibility of a radiologist to read mammography films than typical diagnostic films. The other mammography technologist complained of not being able to complete tasks adequately due to time constraints within the imaging area.

Summary Analysis of the Exploratory Section for the Pilot Interview

Since none of the technologists interviewed were present when the technology was first put into place, they were unable to tell me how it was originally implemented and operated. In the future course of this study, records obtained from the departmental manager can provide this information for the researcher.

All three interviewees were hired from inside the department and received on-the-job training except for interviewee # 3 who received retraining after the existing piece of equipment was replaced.
Incentives for advancement were primarily financial among the three MSHP's except for one of the mammo technologists who sought status redefinition and was entirely self-motivated.

Wage comparisons before, during, and after training were similar in nature for Interviewee #1 and #2, but the third interviewee received no monetary compensation. It is important to note that Interviewee #1 and #2 work at two large comprehensive facilities whereas, Interviewee #3 who did not receive monetary compensation works at the smaller hospital that is a county facility. This speaks to institution-specific cost constraints.

Even though two of the interviewees (#1 and #3) experienced informal authority within their imaging area and the other interviewee (#2) did not experience any change in authority, hospital size did not seem to be a factor with changes in authority. Therefore, the pattern of interaction that the technologist had with the Radiologist was site specific.

In their interviews, not one of the three technologists provided an example of role reversal. The interview method may not be the appropriate tool for gathering such data and the researcher should consider participant observation. Therefore, whenever possible probing questions will be utilized to extract stories about their patterns of interaction with the Radiologist. All three MSHPs implied that the communication with the Radiologist was easier in the imaging suites than in the diagnostic area. This could imply that there is a mutual dependence between the technologist and the Radiologist in the imaging areas.

With regards to the freedom in which to perform duties Interviewee #1 and #3 expressed, greater freedom in which to perform the tasks at hand. Only Interviewee #2 felt that the freedom to perform tasks were similar to the diagnostic area. From the
researcher's perspective, sometimes the Radiologist will afford more freedom to those individuals that he/she feels more capable in performing the tasks at hand.

Nature of task assignments showed a higher level of responsibility among all three MSHP's interviewed and a greater level of difficulty, except for Interviewee #3 who felt that the level of difficulty was similar to the diagnostic area.

Analysis of Summative Section for the Pilot Interview

The summative responses from all three Interviewees revealed a mixture of responses. This could be a clue to the researcher that there may be a gap existing in the way that this interview question was stated and may need to be modified for future interviews.

On the enskilling side, all three were challenged, empowered or liked the responsibility and felt the workplace relations particularly with the Radiologist were better.

From the deskilling side all three felt the same managerial control they experienced in the diagnostic area. Two of the respondents stated that they felt that they had been spread too thin or unable to complete all their tasks in a timely fashion due to time constraints within the area.

When looking at them individually, Interviewee #1 (the CT tech) responses could be classified as deskilled. Interviewee #2's responses are reflective of enskilling and Interviewee #3's responses seem deskilled. Especially in light of the wage discrepancies for her area (no monetary compensation) and the other two modalities (US and CT) whose technologists receive overtime and individual wage increases.
REFERENCES


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