

IOWA VIRTUAL LITERACY PROTOCOL: A PRE-EXPERIMENTAL DESIGN
USING KURZWEIL 3000 TEXT-TO-SPEECH SOFTWARE WITH
INCARCERATED ADULT LEARNERS

By

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An Abstract of a Dissertation by
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The problem: The increasingly competitive global economy demands literate, educated workers. Both men and women experience the effects of education on employment rates and income. Racial and ethnic minorities, English language learners, and especially those with prison records are most deeply affected by the economic consequences of dropping out of school. The purpose of this study is to assess the effect of adaptive technology (text-to-speech software) on incarcerated low-literate adult populations. This study will determine the effectiveness of text-to-speech computer software technology with incarcerated adult learners seeking to improve literacy competencies.

Procedures: The study employed pretests and posttests of a cohort of 24 incarcerated adult learners in two Midwest incarceration facilities segregated by gender. The students spent instructional time using the Kurzweil 3000 text-to-speech computer software in the prison educational center. The study was completed in five months from winter of 2010 to spring of 2011. Data were analyzed using independent samples *t*-tests and a categorical description for student/teacher satisfaction (like or dislike) and ease of use.

Findings: The *t*-test determined there was a significant positive difference between pretest and posttest Comprehensive Adult Student Assessment System (CASAS) literacy scores when using a text-to-speech treatment with adult incarcerated populations with low literacy skills. The majority of students and teacher/mentors experienced satisfaction with the technology usage.

Conclusions: The findings supported literacy improvement by using text-to-speech computer software in the incarcerated adult population of students with beginning low-literacy skills.

Recommendations: Recommendations for future research include expansion of the study to include non-incarcerated adult students, studies of the effectiveness of adult education curricula, advanced professional development for educators working in the prison environment, more accommodating technology application within a blended classroom, and inclusion of a more in-depth longitudinal study to assess benefits over time with the inclusion of multiple assessments and entry points for student engagement.

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Chapter One

Introduction

Statement of the Problem

The increasingly competitive global economy demands literate, educated workers. Education drives the economy, and America seems to be in an educational crisis. On the national level, from 1999 to 2009, the number of Americans who had completed a high school education program rose from 83% to 87% (National Center for Educational Statistics, 2006). However, America needs all students to have 100% completion of a high school course of study. In Iowa, between 10% and 12% of all students do not graduate from high school (Iowa Department of Education, 2010). High school dropouts in Iowa typically have not met the required education standards, which diminishes their life chances. Racial and ethnic minority groups and especially those with prison records are most deeply affected. New ways of supporting literacy could transform the life chances of participants in adult education and augment the educated workforce. The problem is both economic and social.

Why credentials matter. The increasingly competitive global economy demands literate, educated workers. As high school dropouts' earnings and employment rates demonstrate, workers need at least a high school diploma in order to avoid poverty (U.S. Department of Labor, Bureau of Labor Statistics, 2000). High school dropouts have seen their real earnings decline in the previous decade (U.S. Department of Labor, 2000). Sixty percent of the nation's high school dropouts are now older than 40 (Johnston, 2011). Most of them left high school to start working, but few moved beyond low

paying, dead-end jobs. Only 7% of dropouts 25 and older have ever made more than \$40,000 a year (Johnson, 2011). In hard economic times, some will find that not having a diploma puts them at the front of the unemployment line.

High school dropouts can expect to earn significantly less than high school graduates due to both income differences and employment rates. Over a lifetime, a high school dropout will earn \$200,000 less than a high school graduate (Johnston, 2011). For more than 60 years, millions of adults who did not complete their formal high school studies have used the General Educational Development (GED) Tests to realize both personal satisfaction and educational and occupational opportunities. The GED Testing Program provides high-quality tests and accessible testing services for individuals who may benefit from high school diplomas or certificates, awarded by participating jurisdictions in the United States, Canada, and U.S. insular areas (American Council of Education, 2008).¹ However, obtaining a GED is no quick fix for low earnings: it takes time for substantial GED-related differences to accrue (Tyler, 2007). For example, for Black men obtaining GED certificates in prison, they do not realize immediate economic payoff until after five years (Tyler, 2007). A recent study in Florida linked GED Test information to quarterly earnings records collected by Florida's unemployment insurance system. The study included 81,170 individuals, all of whom were between the ages of 16 and 40 when they attempted the GED. Five years after achieving a GED, the GED holders' income showed a 15% gain (Tyler, Murname & Willett, 2000).

But even when high school dropouts use the GED Tests to obtain basic credentials, they often decline to pursue further education, limiting their life chances in a

¹ An example of an insular area is American Samoa. The Samoans have adopted their own constitution, are not American citizens, do not pay federal taxes, and control their own borders. Other examples of insular areas include Guam, U.S. Virgin Islands and Puerto Rico.

demanding global economy. Although approximately 50% of GED candidates indicate they plan to enroll in college, a much lower percentage actually does so. Nationally, only 27% of GED graduates have enrolled in postsecondary education, compared with about 63% of high school diploma holders (Reder, 2007). Yet postsecondary education is essential for well-paid employment (U.S. Department of Labor, 2000) because changes in the economy have increased the educational requirements for long-term economic success (Hilliard, 2011). Between 2004 and 2014, occupations requiring college degrees are projected to grow 19% overall, which is faster than the 13% average growth projected for all occupations (Crosby & Moncarz, 2006).

The economy's demand for well-educated workers is reflected in the stark differences in lifetime earnings and unemployment rates of high school dropouts and college graduates. Over a lifetime, a high school dropout will earn almost \$1 million less than a college graduate (Johnston, 2011). Studies by the U.S. Department of Labor conclude that the unemployment rate for workers who dropped out of high school is nearly four times that of college graduates (U.S. Department of Labor, 2000). On average, the benefits of a four-year college degree are equivalent to an investment that returns 15.2% per year (Greenstone & Looney, 2011). Over a lifetime, the average college graduate earns roughly \$570,000 more than the average person with a high school diploma only, and an associate's degree is worth approximately \$170,000 more than a high school diploma (Greenstone & Looney, 2011). Education is an investment that pays off over time.

Both men and women experience the effect of education on employment rates and income. According to "Working in the 21st Century," a report by the Department of

Labor and Bureau of Labor Statistics, approximately 60% of all women in the United States are in the labor force, compared with nearly 75% of all men (U.S. Department of Labor, 2000). Women now account for 47% of the labor force, an increase of 40% since 1975. Both women and men who have higher educational attainment levels experience more favorable labor market outcomes (Sahin, Song, & Hobijn, 2010).

Uneven effects. The number of students dropping out of school is significant, and the distribution of students who drop out of school is spread unevenly across the American population. Racial and ethnic minority groups, English language learners, and especially those with prison records are most deeply affected by the economic consequences of dropping out of school

Nationally, one student drops out every 11 seconds (Varlas, 2011) and nearly 1 million teenagers stop going to school each year (Johnston, 2011). The 2010 edition of the Iowa Annual Condition of Education Report showed the high school graduation rate for all Iowa student groups was 87.21% (Iowa Department of Education, 2010). In Iowa and across the United States, some groups fare better than others in high school graduation rates.

Gender. In 2005, 11% of males aged 16 to 24 were high school dropouts, compared with 8% of females. Of that population of dropouts, males made up 58.1% of in this age group. Females comprised 41.9% of the dropout rate in this age span (U.S. Census Bureau, 2006). In Iowa, women had higher graduation rates than men, 89.17% and 85.33%, respectively (Iowa Department of Education, 2010).

The single biggest reason that female high school students drop out of school is pregnancy (Johnston, 2011). Latinas have the highest teen pregnancy rates of any racial

or ethnic group; 41% of Latinas who leave high school do so because they get pregnant (Johnston, 2011). These young women end up with few job skills, more pregnancies, and more dependency on unreliable and violent men (Johnston, 2011).

Race and ethnicity. A substantial portion of students do not complete high school in the United States, a problem that is particularly pronounced among the two largest minority groups—Hispanics and Blacks. Green (2001) reports that only 54% of Hispanic students graduate high school and only a slightly higher percentage of Blacks, 56%, complete high school. White (89.2%) and Asian (89.2%) students in Iowa had higher graduation rates than other ethnic or racial groups. Black students had a graduation rate of 68.6% and Hispanics had a graduation rate of 71.6% (Iowa Department of Education, 2010). The U.S. Office of Management and Budget currently defines “Hispanic or Latino” as a person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race.” Source documents do not use the same categorical terms.

Other markers. On average, Iowa students who were eligible for free or reduced priced lunches, had an Individual Education Plan (IEP), were English language learners (ELL), or were from other countries had lower graduation rates than those who did not fall into any of these categories (Iowa Department of Education, 2010).

On the national level, from 1999 to 2009, the number of Americans who had completed a high school education program rose from 83% to 87%. However, the high school dropout rate is still unacceptably high for the Black population, 9.9% versus 4.8% for White students (National Center for Educational Statistics, 2006). Six out of 10 Black male dropouts will spend time in prison (Johnston, 2011).

Literacy and employment. The education and employment situation becomes even more tenuous for immigrants who have been incarcerated. Low literacy levels and lack of high school education are barriers to long-term economic security. Among the alien federal prisoners, over half (55%) were illegally in the United States at the time of their conviction. Administering justice to criminal aliens costs the taxpayer dearly. Incarceration of criminal aliens cost an estimated \$624 million to state prisons (1999) and \$891 million to federal prisons (2002), according to the most recent available figures from the Bureau of Justice Statistics (National Center for Educational Statistics, 2006).

One in every 100 United States adults 16 and older is in prison or jail, about 2.3 million in 2006 (National Commission on Adult Literacy, 2008), and about 43% of these individuals do not have a high school diploma or GED. Ninety-five percent of them return to communities within the United States after being released from the penal system. Of the approximately two million immigrants who come to the United States each year seeking jobs and better lives—the promise of America—about 50% have low literacy levels and lack high school education and English language skills, severely limiting access to jobs. The Census Bureau expects that between 2000 and 2015, net international migration will account for more than half the United States' population growth, with significant effects on the composition of the workforce and the general population (National Center for Educational Statistics, 2006). Low literacy skills will severely hinder up to one million of these immigrants in their attempts to earn family-sustaining wages (Kirsch, Braun, Yamamoto, & Sum, 2007).

How government is responding. United States President Barack Obama has called for greater attention to students who leave the K–12 school environment still in

need of career-ready or college-ready skills (Obama, 2008). In the 2009 State of the Union address, Obama said, “Every American will need to get more than a high school diploma. And dropping out of high school is no longer an option. It’s not just quitting on yourself, it’s quitting on your country” (Obama, 2009). Recognizing that American students no longer compete for jobs only with other local applicants but also potentially with people from all over the world, Obama publicly stated his position in a Chicago church speech in 2008: “To really compete, [students] need to graduate from high school, and they need to graduate from college, and they probably need a graduate degree, too. Let’s give [students] a handshake and tell them to get their butts back in the library!” (Obama, 2008).

While this rhetoric may be inspiring, practical solutions have yet to be established. Dropouts cost federal and state governments hundreds of billions of dollars in lost earnings, welfare, and medical costs, and billions more for dropouts who are incarcerated (Johnston, 2011). Even as the number of incarcerated individuals continues to rise, investments in corrections education do not. In spite of rising prison populations, in 1998 the United States Department of Education capped federal assistance for adult education funding for incarcerated adults at 10 percent of the state grants. That action resulted in a decrease in state expenditures from \$38.6 million in 1997 to \$30.3 million in 2004, the latest year for which data are available (Kirsch et al., 2007).

The United States continues to face an unacceptable rate of high school dropouts, a growing number of Limited English Proficient (LEP) or ELL, an increase in incarcerated populations, and low numbers of adults enrolled in adult education. These variables continue to create economic problems, e.g., self-sustaining lifestyles, revenue

acquisition, and taxpayer expense for incarceration in the United States. And by 2020, the nation will have to bear the burden of an even larger pool of adults with low skills and language deficiencies (Autor, Katz, & Kearney, 2008).

The attainment of credentials such as the high school diploma or GED directly contributes to both individual and collective economic success (Hilliard, 2011). The net fiscal impact for federal, state, and local governments of having 400,000 people earn a high school diploma is estimated at \$2.5 billion a year. If by 2020, four million dropouts were to earn high school diplomas, the net annual fiscal contributions would exceed \$25 billion (National Commission on Adult Literacy, 2008). It is an economic imperative to bring adults back into the education system and put them on track to earn certificates and degrees that qualify them for jobs at family-sustaining wages (Khatiwada, McLaughlin, & Sum, 2007).

Educational upgrading has been found to diminish the rate of unemployment (Phelps & Zoega, 1997, 1998). An increase in educational attainment is generally accepted to be associated with a lower likelihood of unemployment (Moen, 1999). In the competition for jobs, workers choose to increase educational attainment in order to increase their employment prospects and status. “People need interim skills and credentials along the way, as work is a fundamental part of life, but the goal and series of steps is to a postsecondary credential or ultimately a degree” (Hilliard, 2011).

To that end, the National Commission on Adult Literacy (2008) recommends the transformation of the adult literacy and education system into an adult education and workforce skills system with the capacity of effectively serving 20 million adults annually by the year 2020. Building capacity to serve 120 million adults by 2020 will

require annual enrollment gains, with corresponding improvement of system infrastructure and funding based on measurable outcomes (National Commission on Adult Literacy, 2008). Adding 20 million more postsecondary-educated workers over the course of the next 15 years is not impossible (Carnevale & Rose, 2011). These 20 million additional workers would meet the growing demand for postsecondary-educated workers, boosting the gross domestic product by \$500 billion (Autor et al., 2008).

Educating these workers requires thoughtful new approaches. Because younger adult students have grown up in a digital environment, they may actually think differently than older people who did not grow up in the digital environment (Kelly, McCain, & Jukes, 2009). Educators of younger adult learners must adapt their approaches to instruction and the organization of their schools to address this new reality if they hope to engage students in learning (Kelly et al., 2009). Computer tools that provide a synchronized visual and auditory presentation of text appear to have considerable promise as compensatory aids to people who have poor reading skills (Elkind, 1996). However, not all students in adult education classrooms were trained within this new, digitally enhanced paradigm. Some students see “doing school” much the same today as in their earlier formal educational experiences, no matter how long ago they took place. For them, the use of technology may be perceived as “fluff,” unnecessary for educational attainment. A blended classroom, using both technology and guided facilitation of learning by a teacher, is the current practice in high achieving schools (Iowa Department of Education, 2011b). Blended learning is gaining momentum and is becoming a tool to solve problems in the dropout crisis (Varlas, 2011).

Statement of Purpose

The purpose of this study is to assess the effect of adaptive technology on incarcerated, low-literacy adult populations. This study will determine the effectiveness of text-to-speech computer software technology with incarcerated adult learners seeking to improve literacy competencies.

Research Questions

The following research questions guide this study:

1. Does text-to-speech adaptive educational technology improve low-literate incarcerated adults' reading competency scores?
2. Does adaptive educational technology improve low-literate incarcerated adults' reading competency scores differently by (a) age, (b) gender, (c) ethnicity, (d) ELL status, or (e) initial literacy level?
3. How do low-literate incarcerated adults and teacher/adult mentors explain their level of satisfaction (like or dislike) with the adaptive educational technology?

The above research questions used in this study are aligned to the mission of adult education in the Midwest prison sites segregated by gender.

The mission of correctional education is threefold. First, as inmates gain knowledge and skills, they should be qualified for employment upon their release into the community. Second, education in prison should serve as a mechanism that enables inmates to learn to think more responsibly. Finally, this combination should make it less likely they will return to prison (Messemer & Valentine, 2004).

Significance of the Study

This project reveals both complexities and possibilities in adult literacy and learning through the use of technology. This study provides evidence that supports the use of text-to-speech computer software to assist adult learners in acquiring literacy skills necessary to compete in the global economy and create a better life for themselves and their families. It uncovers important data for educational practitioners who work with incarcerated populations, drawing on technology use just as schools and other institutions do. Text-to-speech computer software can increase literacy competencies and assist learners in acquiring GED certificates. Such technology engages adult learners in becoming active in their own educational goals, creates a sense of ownership and self-efficacy in their educational journeys, and helps them to feel empowered to change their circumstances and lives.

Conceptual Frameworks

Anderson (1983) explains that a theory is a precise deductive system that allows one to accurately predict behavior given knowledge of the variables within a theory. Dual Coding Theory (DCT) informs the current study with its equal valuing of both verbal and non-verbal processing. DCT emphasizes the importance of having multiple modalities present during learning (Ryu, Lai, Colaric, Cawley, & Aldag, 2000).

DCT assumes that there are two specialized cognitive subsystems: one for the representation and processing of nonverbal objects and the other for language. “Human cognition is unique in that it becomes specialized for dealing simultaneously with language and with nonverbal objects and events...any representational theory must represent this dual functionality” (Paivio, 1986, p. 53). In concept learning and language,

DCT suggests that new information is easier to absorb and use when it is presented in multiple modalities simultaneously.

DCT emphasizes the importance of nonverbal and verbal components in reading. The theory postulates that visual and verbal information are processed differently although they do not compete with each other. DCT provides a unifying framework for literacy and reading. When people read written information, DCT contends, they access this information through multiple senses.

DCT is relatively new in the field of literacy. Paivio's work, with slight adaptations, has advanced the development of educational materials. For example, methods that employ dual coding principles have been used in remedial education for students with learning difficulties (Paivio, 2006). Text-to-speech software also utilizes a modification of dual coding methods by allowing students to read the text and listen to the text at the same time. In Paivio's (1986) presentation of DCT, "dual" requires both verbal and nonverbal modes. Text-to-speech software instead uses two different forms of verbal communication—written and spoken. Thus, DCT theory is slightly modified in this study.

In the text-to-speech software used in this study, words on a computer screen are highlighted in single word, sentence, or paragraph configurations depending on learner preference. At the same time, the words are read aloud to the student, who hears the words through headphones. This method is supplemental to traditional classroom teaching methods, in a "blended" approach. In a blended classroom, a teacher facilitates and fosters students' engagement with the curriculum embedded within the technology that is being used. When combined with a mix of learning options, strong practitioner

leadership, resources, and data systems that track learning, blended classrooms can help students significantly (Varlas, 2011).

Human capital theory's view of the value of education also guides this study. In human capital theory, humans are a factor of production in a typical business. Distinct from labor, which is a person's capacity to perform basic tasks, human capital includes a person's knowledge and skill sets (Olaniyan & Okemakinde, 2008). A person sells these abilities and skills when he or she provides services to a company; the company pays for these abilities and skills. People do not sell themselves so much as they sell their skills and competencies. Thus, costly expenditures on training and education should be considered investments because they are undertaken in order to increase personal incomes. Human capital can include general assets, such as the ability to read and write, or specific ones, such as a particular skill or set of skills.

Human capital theory emphasizes that education increases the productivity and efficiency of workers by increasing the level of human capability. Formal education is seen as a productive instrument in human capital. The rationality behind investment in human capital is based on three arguments:

1. the new generation must be given appropriate knowledge, which has already been accumulated by previous generations;
2. the new generation should be taught how to use existing knowledge to develop new products and processes; and
3. people must be encouraged through creative approaches (Olaniyan & Okemakinde, 2008).

Education plays a significant role in the economy of a nation; thus educational expenditures are found to constitute a form of investment. Education increases chances in the labor market and opportunities for job mobility. Many developing nations realize that the principal mechanism for developing human knowledge is their educational system. They invest huge sums of money in education not only as an attempt to impart knowledge and skills to individuals but also to impart values, ideas, attitudes, and aspirations which will be in the nation's best developmental interests (Olaniyan & Okemakinde, 2008).

A broad variety of theorists has recognized the connection between human capital and life chances. Olaniyan & Okemakinde (2008) identified English philosophers John Locke (1632-1704) and John Stuart Mill (1806-1873), Scottish economist Adam Smith (1723-1790) and German social theorist Karl Marx (1818-1883) as theorists supporting the need for advanced education in creating positive life circumstances. Davis (2006) described advancing education as having a dual purpose for students. First, it may allow for a better occupation with higher income, and second, it directly relates to higher status attainment or social mobility.

Students entering a pre-GED adult literacy program appear to be seeking both types of advancement. The pre-GED curriculum contains literacy levels commensurate with the reading skills that students possess at the time of enrollment. Adult education must teach students to value learning over the appearance of smartness, to relish challenge and effort, and to use errors as a route to mastery (Dweck, 2000). If students have perceived a needed change, the text-to-speech computer software programs

available at GED program sites may increase students' chances of mastering the content and thus completing GED requirements.

Summary

This study builds upon prior research regarding the instructional practice knowledge base required to effectively assist adult learners. The students in the study do not have the necessary reading competencies to be able to master GED study program content required for a successful completion of the GED exam.

Chapter 2 outlines current research pertaining to adult literacy competency and adult learning. Chapter 3 presents the methods used in designing and conducting the study, including the methodological approach, data sources, and data analysis procedures. The analysis employed in Statistical Analysis System for Windows (SAS) was the independent samples *t*-test. Chapter 4 presents analysis of the data, categorized by research questions. Chapter 5 summarizes the study and includes a discussion, conclusion, and recommendations for further study.

Chapter Two

Review of the Literature

Education is not the filling of a pot, but the lighting of a fire—William Butler Yeats

The research questions for this study respond to issues raised in the literature concerning how teaching and schools are organized, how adults learn, and why literacy and credentials matter. The present study's design responds to the literature. This chapter will detail the relevant issues in the literature.

How Teaching and Schools Are Organized

Some of the most famous great teachers of ancient times - for example, Jesus, Plato, and Cicero - were teachers of adults. They and their peers perceived learning to be a process of engaged mental inquiry, not passive reception of transmitted ideas (Knowles, 1998). Beginning in the seventh century, the latter understanding of learning supplanted the one that these great teachers used. More recently, scientific investigation of adult learning processes has produced knowledge suggesting that educators ought to revive this ancient approach to teaching and learning. Educational programs revolving around engaged mental inquiry can help Black and Hispanic students, English language learners (ELL), immigrants, and the incarcerated achieve the credentials needed for better life chances.

Many ancient societies conducted adult education in ways that modern research would support. The ancient Chinese invented techniques in which a group leader described a scenario, often in the form of a parable, and together students developed solutions. The ancient Greeks invented Socratic dialogue, in which a group member posed a question or dilemma and all of the members pooled their thinking and

experiences to seek an answer or solution. The Romans were more confrontational: they used challenges that forced group members to state positions and then defend the positions (Knowles, 1998).

The early teachers in formal educational settings had formulated a very different concept of teaching and learning than the one that had dominated most education up until that time. The contemporary educational system in the United States relies upon a model of education developed in seventh-century European schools. These schools prepared young boys to become priests, so educators' mission was to teach about the rituals of the church. These educators developed a set of assumptions about learning and strategies for teaching labeled "pedagogy," the method and practice of teaching children in a formal educational setting. The term *pedagogy* refers to the art and science of teaching. The early pedagogical model assigned a teacher full responsibility for making all decisions about what would be learned, how it would be learned, and determining whether it had been learned. It was teacher-directed education, leaving to the learner only the submissive role of following instructions. The term originally was more descriptive and less prescriptive than might be used today in the educational community.

In the twentieth century, the assembly line model, behaviorist thinking, and shifts from holistic to specialized education and from teacher-led to centralized decision-making converged to shape American schools into the form that many of them hold today. In the early 1900s, Henry Ford's assembly line, a method of production based on scientific management, led to dramatic improvements in productivity at Ford (Kelly et al., 2009). These improvements aroused great excitement about applying scientific management ideas in a broad array of institutions, including schools. The assembly line

model went hand-in-hand with the behaviorist approach to learning, which was put into practice in schools as early as 1926 (Prensky, 2010). This approach, focused on the memorization skills critical for workers on the production line, sought to improve students' performance by giving students only small, discrete portions of information in a predetermined sequence. Many schools abandoned the holistic approach, in which teachers taught many subjects to students of a wide range of ages in middle school and high school, in favor of specialized departments. In this new organizational scheme, teachers occupied classrooms in which they would teach for short periods of time, typically one hour, until a bell rang and students moved to another specialist. The basic layout of contemporary schools, with their hallways, classrooms, and departments, was created before the Great Depression.

The assembly line and behaviorist approaches were reinforced when, in the early years of the 20th century, decisions about teaching, curriculum, assessment, and learning passed from the hands of teachers to commercial textbook publishers and test makers (Jukes, McCain, Crockett, & 21st Century Fluency Project, 2010). Rather than being concerned with the needs of individual students, the school became an institution for sorting students, preparing them for roles they would assume upon leaving high school. A small number of the most intellectually gifted students would become managers and leaders. A larger number of students would become skilled workers and merchants, and the vast majority of students would become manual laborers (Jukes et al., 2010).

The approach to education that has arisen from these influences tends to overlook the needs of individual learners in favor of other concerns. Some believe that contemporary schools differ radically from the schools of the early 20th century (Kelly et

al., 2009), given the presence of computers, networking, digital phones and PA systems, and digital whiteboards. However, the underlying structures and organization of the school remain unchanged. Further, the instructional approach of teachers who talk to students as they sit passively in their seats continues to be the main teaching strategy of the vast majority.

The educational system in American prisons is no exception. The adult education program provides workbooks with content/skills that align with General Education Development (GED) tests. Students are generally not required to solve real-world problems or collaborate with other students, nor do they participate in the formation of relevant questions and possible solutions. Learners are not required to personally construct knowledge, provide evidence of elaborated communication, or grapple with thinking embedded in real world issues.

How Adults Learn

Educational research makes clear that the centralized, behaviorist, assembly line approach does not serve all learners equally. Gradually, researchers have come to understand that as individuals mature, their need and capacity to be self-directive, to use their experience in learning, to identify their own readiness to learn, and to organize learning around life problems increases steadily from infancy to preadolescence, and then increases rapidly during adolescence (Bruner, 1961).

In focusing on adult learners, these needs and capacities become especially important. In 1926, the American Association for Adult Education was founded. Adult educators began to publish scientific evidence that adults possessed interests and abilities that were different from those of children. A growing body of notions about the unique

characteristics of adult learners began emerging in the United States and Europe (Knowles, 1998).

Eduard Lindeman, influenced by the philosopher John Dewey, laid the foundation for a systematic theory about adult learning in 1926 (Lindeman, 1926). Lindeman wrote that adult education should focus on situations, not subjects. He believed that the current system of education was backwards, placing subjects and teachers at the center and students at the periphery. In adult education, Lindeman argued, the curriculum must be built around the student's needs, interests, and experience. Experience, Lindeman wrote, was the resource of highest value in adult education, equal to the teacher's knowledge: "Experience is the adult learner's living textbook" (Lindeman, 1926, p. 9–10). This pioneering theorist identified key features about adult learners in 1926 that have been supported by later research and constitute the foundation for adult learning theory (Pressey & Kuhlen, 1957).

Malcolm Knowles, an American adult educator in the early twentieth century, viewed adult learning as discovery, in which the adult learner grew through insight and direct, early application of learning. Knowles coined the term "andragogy," the art and science of helping adults to learn, to describe the set of methods and practices more suited for adult learners (Tough, 1971). The andragogical model is based on the assumptions that adults need to know why they need to learn something, they understand themselves to be responsible for their own decisions and lives, and they come into education with a different quality and amount of experience than children do. In sum, adult learners come to educational programs ready to learn what they need to know and be able to do in order to cope effectively with real-life situations (Taylor, 1997). Most

adults are motivated to keep growing and developing, but this motivation is frequently blocked by such barriers as a negative self-concept as a student, inaccessibility of opportunities or resources, time constraints, and programs that violate principles of adult learning (Tough, 1971).

Later studies continued to show that adults were motivated to learn when they experience learning that satisfies their needs and interests. Adults' orientation to learning was life-centered and self-directed; their individual interests became more focused and fewer in number as they aged (Lindeman, 1956). These factors were identified in a study that used in-depth interviews with 22 adult continuing learners. It delineated three types of adult learners (Houle, 1992). First was the goal-oriented learner, who used education to accomplish clear-cut objectives. These individuals usually did not start their continuing education until their middle twenties and after - sometimes much later. A second group, activity-oriented learners, took part because they sought social contact, and their selection of any activity was based on the amount and kind of human relationship it would yield. Learning-oriented adults who sought knowledge for its own sake comprised the third group. Unlike the other groups, this group had been engrossed in learning by being avid readers, they joined groups for educational reasons, they selected serious programs on television, and "made a production" out of travel (Houle, 1992).

Another study determined that adult learners anticipated several desired outcomes and benefits, which they attained in phases (Tough, 1971). Their desired outcomes and benefits included satisfying curiosity; engaging with the content itself; enjoying the practice of the skill and activity of learning; producing something, imparting knowledge or skill to others, or understanding what might happen in some future event; pleasure; and

increased self-esteem. This study also determined that adult learners proceed through several phases in learning, which are related to the desired outcomes and benefits. The first phase is deciding to begin. It consists of several steps: setting a goal, assessing interests, seeking information regarding opportunities, establishing a desired level or amount of learning, and estimating its benefits. The second phase is choosing a plan that is proactive rather than reactive and collaborative rather than dependent. The third phase endorses using a variety and richness of resources and developing the learner's skill in making use of them. These phases were later expanded into ten tenets that comprise a transformational learning theory (Mezirow, 2000).

While studies have helped articulate an understanding of how and why adults learn, any particular learner in a particular learning situation is likely to exhibit different capabilities and preferences (Grow, 1991). Because individual learners' needs are likely to vary widely, the teacher has to structure a group learning situation to accommodate all students' learning needs. Educators generally do not accept the assumption that all learners have full capacity for self-teaching and personal autonomy in every learning situation. Yet the teacher can structure his or her relationship with each student in order to facilitate the unfolding of self-directed learning. Self-directed learning is situational and the teacher's role is to match various learning opportunities with individual student needs.

Grow (1991) identifies four levels of teacher responsibilities which correspond with learner needs. Stage one portrays a dependent student who requires prescriptive teaching and the teacher is the purveyor of knowledge. While the coach provides immediate feedback and drill, the teacher provides informative lectures. The interested

student in stage two requires a teacher who is a motivator and guide. Instruction will include inspirational lectures followed by guided discussions. In stage three, the involved learner requires a facilitator who acts as an equal, providing opportunities for project work and seminars. In stage four, the student is self-directed and the teacher will serve as a consultant. Mismatches between teacher and student can occur in either direction. Too much self-directedness can be as big a problem as too little, depending upon the learner (Iowa Department of Education, 2011b). For example, a learner who is experienced with the subject matter and has strong learning skills is likely to be frustrated in highly controlled learning situations. Conversely, a learner who is inexperienced with a subject and has poorly developed learning skills will likely be intimidated, at least initially, in highly self-directed learning situations.

A comprehensive model of self-directed learning is based on three core components: self-management, motivation, and self-monitoring (Garrison, 1997). The teacher of adult learners has traditionally focused on only the first component, the control of learning, or self-management, and not the learning process or motivation. Students may sit for hours in an adult education class with books open but never collaborate, never create questions, and never clarify their thinking through reflective learning practices.

Equal attention should be focused on motivational issues, including the motivation to engage in self-directed learning and to complete self-directed learning tasks (Iowa Department of Education, 2011b), in order to improve students' life chances. In the typical adult educational learning environment, students are assigned worksheets in workbooks, a task for which students may be unlikely to be motivated or self-directed. Worksheet completion may not afford students the opportunity to develop the

metacognitive skill of self-monitoring, which students need in order to engage in self-directed learning. This is a skill that must be mastered and this skill can be taught if it is not mastered independently. Self-monitoring and self-directed learning are skills that enable students to learn and grow. Adults who are willing and able to learn can make positive contributions to the economic sphere of society, but those who exhibit static instead of dynamic characteristics are unable to maintain or improve their social and economic status. These skills, then, are very important for students' life chances, and adult learning professionals need to pay attention to all three components.

Sub-Populations

Almost all adults can benefit from assistance in their learning journeys, and a significant number of adults require help. Some adults are not motivated to learn or have difficulty learning—for example, those who are incarcerated in jail or prison, racial minorities and English language learners. High rates of incarceration in the United States are tied to under-education, race and unemployment (Darling-Hammond, 2010). The United States has 5% of the world's population and 25% of its prison inmates. Most U.S. prison inmates are high school dropouts, and many are functionally illiterate and have learning disabilities (Darling-Hammond, 2010). A highly disproportionate percentage of inmates are individuals of color from the lowest rungs of the social ladder. Despite the confusion that surrounds the ways Americans think about it, race continues to have profound effects upon life experiences in our society (Boykin & Noguera, 2011). From dropout to incarceration rates, race remains a highly significant variable within the U.S. population. Ignoring these patterns under the guise of pursuing color-blind social policies does not cause them to disappear, though it may make them harder to detect and address.

More than one in 100 American adults are behind bars; one in nine Black men aged 20 to 34 are serving time, as are one in 36 adult Hispanic men. The *New York Times* recently dubbed the United States as the “prison nation” (“Prison Nation,” 2008). These populations have much to gain from improved literacy skills.

Black students. The limited research in the area of Blacks who are incarcerated in the U.S. suggests that Black students face particular vulnerabilities beyond the normal challenges as they start high school (Benner & Graham, 2009). Almost half a million Black teenagers drop out of school each year (Johnston, 2011). Most will end up unemployed by their mid-30s. Six out of 10 Black male dropouts will spend time in prison (Johnston, 2011). Of all ethnicities – and both genders – Black males show the greatest increase in suspensions after transition to high school (Holzman, 2004).

Black students are often exposed to blatant racial stereotyping. Media images of Black people are disproportionately negative (Entman & Rojecki, 2000). School personnel often transmit the belief that they do not expect Black students to excel academically (Hurst, 1992). If educators interact with students on the basis of stereotypes, the students’ behavior could manifest these very expectations. There is a severe shortage of positive educator role models because of the severe shortage of Black teachers in the public schools (Brownell, Ross, Colon, & McCallum, 2005).

It is not uncommon for Black students and families to distrust schools and school personnel, finding their schools uninviting or unfriendly to their culture and its strengths. Research has indicated that Black parents feel that school personnel question or criticize their parenting skills, abilities, and values (Kalyanpur & Rao, 1991). A language and cultural schism between the schools and students and their families often occurs

(Fordham, 1996). There is no indication that parents of Black students hold them back from striving to meet their highest potential in education (Maldonado & Farmer, 2006).

Low-performing Black students receive two opposing messages: their families send messages of hope and mobility, but their schools suggest deficiency and helplessness (Fine, 1991). Fortunately, many Black high school students are resilient enough to navigate these stumbling blocks and proceed confidently. However, too many become stymied and give up completely (Holzman, 2004). Ethnicity plays a huge role in shaping behavior and has been identified as a significant factor in Black student achievement (Lee, Spencer & Harpalani, 2003). Ethnic identity development is important to students' overall growth (McMahon & Watts, 2002). There is a need to fit in and belong; these social concerns sometimes become more important than academics.

Hispanic students. Young Hispanics have a high rate of participation in the workforce, which limits their time and energy for education.² Hispanic males aged 16 to 19 have an employment rate of 46%, compared to their White counterparts at 1.6% (Hernandez, Siles, & Rochin, 2001). Students in urban areas are now required to become adults much more rapidly and to be able to adapt to rapidly fluctuating labor markets (Bennet, 2007). Hispanic youth have more problems obtaining a high school diploma due to the recently increased requirements (e.g., more high school classes in mathematics, science, and language) of formal education (Bennet, 2007). In Iowa, the high school credits needed for graduation have increased from 18 to 24. Their educational attainment as a group is lower than that of other ethnic groups (Johnson, 2011). The Hispanic population is the most underrepresented population in terms of providing students with

² Hispanics include all Latinos and people born in Puerto Rico, Mexico, Central, and South America.

educational scaffolding to flow through the educational system into a higher education or degree attainment system (Chapa & De La Rosa, 2006). Schools do not provide the needed scaffolding for students who must work substantial hours outside of school time.

Low educational attainment can be linked to the language barriers faced by many Hispanic individuals seeking employment within the United States (Maldonado & Farmer, 2006). Hispanics often believe that learning English is the primary way to earn a better life in the United States (Hernandez et al., 2001). Hispanic enrollment in four-year universities is growing; the relative number of Hispanics obtaining a bachelor's degree in 2000 was 10%, compared with Blacks at 18% and Whites at 34% (Arbona & Nora, 2007).

Hispanic students have the lowest socio-economic status in the United States and may also have problems with information access that is usually available to other cultures (O'Connor, 2009). Many reports of discrimination have been made, which lead to the widening of the socioeconomic gap (Cardarelli, Cardarelli, & Chiapa, 2007). Challenges that face the Hispanic population are the increasing numbers of high school dropouts, gang involvement, teen pregnancy, and HIV health problems (Hernandez et al., 2001). The Hispanic population is important for the future of the American workforce (Maldonado & Farmer, 2006), as it continues to grow in the United States (Chapa & De La Rosa, 2006).

English Language Learners. Another population in need of support in learning is the English language learner (ELL). As a result of political changes around the world and increased awareness of economic contrasts in quality of life between countries, many first-world nations are experiencing an influx of immigrants. English-language countries

such as the United States struggle with educating immigrants in English so that they can pursue the opportunities afforded them in their new country. The complexity of this issue is compounded by the fact that ELL students are an extremely varied group. Many have experienced traumatic situations in their country of birth and may not have had access to education at all. Others are highly literate in their own language, have been highly educated in their native country, and are more easily able to achieve educational success in this country (Ruiz-de-Velasco & Fix, 2000; Schifini, 2002; Suárez-Orozco & Suárez-Orozco, 2001). Those who were excellent students in their country of birth can feel frustrated, since it is often difficult for them to be recognized as such in their new country. Students may struggle with the lack of culturally relevant academic background and ongoing linguistic challenges. Barriers need to be removed for ELL students so they can reaffirm their own potential.

It takes time for all language learners to gain a new language. They must learn social language as well as a more difficult academic language. It takes between five and 10 years to gain proficiency in academic language (Cummins, 1986). Meanwhile, native-English speaking peers are learning content and new language, making it more difficult for ELL students to catch up. This can be frustrating. The challenge for educators in the United States is to facilitate the language-learning process and teach content so that these students are able to access and utilize educational opportunities to become successful citizens in their new nations (Department for Education and Skills, 2004). “Language, academics, and cognitive development all go hand in hand. As students increase their knowledge of second language across all subject areas, they need to have continuing development of thinking skills” (Ovando & Collier, 1998, p. 114). Academic learning

needs to be made comprehensible to English language learners throughout the continuously evolving process of interaction between language and cognition (Baker, 1996).

Prison populations. Helping incarcerated students experience success as they attend education classes in the prison setting is challenging. If the purpose of educational programs in prisons is to train individuals to become productive members of society, then studies should focus on measuring educational gains and enriching this quantitative data with qualitative research concerning student responses to educational methodology (Wade, 2007). The premises of correctional education are threefold. First, as inmates gain knowledge and skills, they should be qualified for employment upon their release into the community. Second, education in prison should serve as a mechanism that enables inmates to learn to think more responsibly. Last, this combination should make it less likely that they will return to prison (Messemer & Valentine, 2004).

In some states, prisons have faced the prospect of elimination of educational programs. During the 1970s, policy makers became disillusioned and concerned with the ineffectiveness of prison education programs after the publication of what became known as the “nothing works” report (Lab & Whitehead, 1990): the incarcerated population did not seem interested in learning. In response, the pendulum swung toward a “just-deserts” model, which focused more on punishment than rehabilitation of prisoners. This resulted in fewer prison education programs. During the 1990s, two attempts were made in Maryland to reduce or eliminate correctional education programs (Tracy, 1998). Thus, it is important to closely examine policy as well as correctional education programming to

determine what does work, why it works and how to insure building capacity for continuation of best practice.

Providing successful correctional education is not a simple task. Running successful educational programs in prisons is challenging: learning environments are not usually conducive to concentrating, an eclectic student population has varying educational needs and motivation levels, too few spaces exist for the number of inmates who would benefit from an education, and limited resources are available to pay for teachers and supplies (Gehring, n.d.; Harr, 1999; Management & Training Corporation Institute, 2003). Exploration of context and mechanisms of education programs in the prisons is a necessary step to providing successful programming. It is also necessary to determine how to maximize educational programs to foster a smooth transition from prison life to the community.

The key criteria in evaluating the success of prison education programs shown in the literature are reduced recidivism and, less commonly, educational achievement (Jancic, 1998). Inmates' learning gains can be measured using the Tests of Adult Basic Education (TABE), which require the use of pretests and posttests as a means of measuring educational achievement. Inmates who were previously considered at risk of academic failure became successful in the classroom and made significant learning gains in reading, math, and language (Messemer & Valentine, 2004). Success can also be defined as progressing from one level to the next level in educational achievement scores. Inmates can achieve learning gains, and learning gains are correlated with lower recidivism rates (Fabelo, 2002).

Most correctional education research is driven by theories that advocate individual change and rehabilitation (Wilson, Gallagher, & MacKenzie, 2000). Collectively these theories support the notion that offenders can change and successfully reintegrate into society with the help of programming within and outside the prison walls, including education. Although there are scholars who believe in the “nothing-works framework,” counteracting rehabilitation theories (Ubah & Robinson, 2003), research does exist specific to educational programming showing that it can work. In contrast to the “nothing works” theory, research supports individual change theory through increasing adult learner opportunities (Wilson et al., 2000).

Although the body of literature on prison education is not extensive, it is growing, and its importance has been increasingly noted. Programs stressing achievement of educational outcomes and credential attainment, such as passage of all five GED subtests, rather than just the process of education, are more successful (Management & Training Corporation Institute, 2003). In other words, students need a goal that makes “study-time” a worthwhile task that will provide future benefits.

At an individual level, correctional educators are often trying to teach students who have failed within regular schools: they are apathetic learners; have learning, emotional, or drug problems (and sometimes co-occurring disabilities); and have a history of violence and low self-concept (Management & Training Corporation Institute, 2003). “The contrast between an inmate population and the general population is that 41 percent of the inmates do not have a high school diploma or GED compared with 18 percent of the general population” (p. 2). Because of these characteristics, inmates often have low motivation to participate in educational programming, leading some researchers

to suggest making class attendance mandatory in all prison environments. Class attendance is the first step in achievement, and research has found that mandated students achieve just as much, if not more, than voluntary students (Nuttall, Hollmen, & Staley, 2003). Inmates find it nearly impossible to retain motivation and the positive aspects of educational programs when constantly bombarded by intense negativity. Prisons are the breeding ground for the kind of aggression and anger that teach life-long lessons for the majority of those who experience them (Harr, 1999). Inmates may be too preoccupied with their surroundings, keeping safe, and worrying about what others are thinking about them to actually focus on educational programming. If safety and security are not priorities within a facility, rehabilitation is not likely (Management & Training Corporation Institute, 2003). If education is effective in reducing recidivism, more information is needed about which students are getting access to education and how facilities maximize resources.

One prison educational model that focuses on rehabilitation does so by training staff in cognitive-behavioral methods so that the staff supports individual change. More than half of the overall GED attainment rate was due to quality of education, leaving almost half of the GED attainment rate explained by prisoners' access to education (O'Neill, MacKenzie, & Bierie, 2007). If resources to educational programming were increased, there could be an increase in the number of students who could obtain the GED, despite the difficult learning environment.

The initial pass rates on the GED exam vary greatly by race or ethnicity and by age within the race or ethnicity (Tyler, 2007), among all takers of the test, not just those in prisons. About 77% of White GED candidates (of all ages) pass on the first attempt,

while only 66% and 46% of Hispanic and Black (respectively) pass on their first attempt. Among White and Hispanic candidates, the lowest initial pass rates occur among candidates who are 19-21 years when they take the tests, and the highest pass rates are for candidates who are 30 and older. However, among Black GED candidates, the highest pass rates are among the youngest candidates, those who were 16-18 when they took the tests, and the lowest initial pass rates were among those who were age 30 and over. There were no substantial gender differences in initial pass rates (Tyler, 2007).

The age difference on initial pass rates suggest that GED preparation programs are most important for young individuals who have been out of school for two to four years and for Black candidates who are age 30 or over (Tyler, 2007). What is not clear from research are the reasons why individuals who were 19-21 when they initially took the tests consistently passed at lower rates than individuals who were 16-18 when they took the tests. It could be that the older candidate group was composed of individuals who left school with lower levels of skills than individuals who tended to test sooner after leaving school. Or, the two groups left school with the same types of skills, but the skills of 19-21 year-old groups eroded relative to the skills of the younger group. Understanding these mechanisms is important because different types of GED preparation programs may be more or less effective in helping students of different age groups pass the exams.

Preparation for the GED can take place through different formats. Thirty percent of GED graduates in 2006 studied for the test through federally funded adult education programs (Reder, 2007). Most students entering an Adult Basic Education (ABE) or Adult Secondary Education (ASE) program aim to successfully complete the five-part

GED examination. They take the Comprehensive Adult Student Assessment System (CASAS) for instructional placement in either ABE or ASE. ABE students may require basic reading that includes work with phonics and alphabetization. Students at both levels are guided to a pre-GED study program with the express purpose of raising their literacy competency score in order to pursue GED course work. All pre-GED curriculum is oriented toward students with a low literacy score.

Other kinds of delivery models may be needed to reach adult learners, such as text-to-speech computer software available at adult education centers or the GED-I Pathway online services being implemented in Iowa. GED-I Pathway is a program offered to students so that they can study on their home computer as well as in the formal classroom. This is a blended classroom approach: the use of technology and a teacher to increase student learning.

The content of adult education curricula and assessments must be aligned with skills and content required on commonly used college placement tests (Mellard & Anderson, 2007). Unfortunately, often this alignment does not exist (National Commission on Adult Literacy, 2008). About 85% of GED graduates who enroll in postsecondary education must take at least one remedial course, which lengthens the time it takes to earn a credential or degree and increases instructional costs (Duke & Ganzglass, 2007).

Candidates who fail the GED exams may retake the tests. About 65% of White candidates who fail on their initial attempt retake the exams within three years, while about 60% of Blacks and Hispanics retake the test (Tyler et al., 2000). For all groups, younger candidates tend to retake the exams at a higher rate than older candidates.

Particularly notable is that while Black candidates had pass rates that were 30% lower than White initial pass rates, there is about a ten percentage point difference in the pass rates among retakers (71% for Whites versus 60% for Blacks). Also, Hispanics who retake the exams have pass rates that equal those of the White retakers. The ultimate pass rates in the data for all GED candidates are 88% for Whites, 66% for Blacks, and 80% for Hispanics (Tyler, 2007). This suggests that providing individuals the opportunity to retry upon failing is an important provision if one goal of the examination system is to diversify the pool of individuals who eventually pass.

The success of GED test-takers is undoubtedly impacted by the decline of reading among Americans generally. In a large-scale study on the reading habits of American people, based on 17,000 interviews with people of all ages and a wide range of ethnic backgrounds, the National Endowment for the Arts (NEA) found that less than half of the adult American population now reads literature and that total book reading across all subject areas is declining significantly (National Endowment for the Arts, 2007). From 1992 to 2002, reading of any book declined by 7%, while reading of literature declined by 14%, across racial lines. The decline in reading was most acute in young people.

Research suggests several avenues for increasing adult literacy and English language proficiency. Most of the findings derived from adult education reading instruction research are emerging findings because they are based on a relatively small body of experimental research (Kruidenier, MacArthur, & Wrigley, 2010). There is more research focused on children. The small size of the research base on adult education reading instruction precludes establishing more than half a dozen robust findings based solidly on large numbers of research studies that have been replicated. Adult education

research does indicate that adults can make progress in each component of reading and ultimately improve their reading comprehension, the goal of reading instruction (Kruidenier et al., 2010).

Adult learners may have had negative childhood school experiences and harbor anxiety about reading books. While previous reading experiences cannot be changed, an extensive reading approach (plentiful access to written text through text-to-speech access) is an example of an instructional strategy that includes many positive exposures to the reading experience. There are benefits to an extensive reading approach in both learning a second language as a native English speaker and learning a language as a citizen in an environment with a different language (Day & Bamford, 1998). Both child and adult students “increased their reading ability in the target language, developed positive attitudes toward reading, had increased motivation to read, and made gains of proficiency in the target language, including vocabulary and writing when given access to large amounts of printed text” (p. 33). For children, a correlation exists between frequency of reading and reading achievement (Anderson, Wilson, & Fielding, 1988). For example, on the 2000 National Assessment of Educational progress (NAEP), nine-, 13-, and 17-year-old students who read more printed text each day performed better on the NAEP reading measure. Although not verified with the adult literacy population (Padak & Bardine, 2004), it is logical to conclude that the same correlation could exist for adult learners. But most adult literacy classrooms focus only on teaching basic reading skills and/or preparation for the GED test and do not create a classroom atmosphere in which adult learners are encouraged to read authentic materials, such as books, magazines, and newspapers (Beder & Medina, 2001; Purcell-Gates, Degener, Jacobson, & Soler, 2002).

The impact on English-reading outcomes of encouraging students to read may be more positive when the reading takes place in English (Hafiz & Tudor, 1989). English language learners from Pakistan were placed in a classroom in the United Kingdom, and their performance was compared to that of two other classrooms of English-language learners. The experimental subjects were given additional reading time (one hour per day after school on a voluntary basis). In a series of independent *t*-tests, the experimental group consistently showed gains during the experimental periods, whereas the control group did not. There are many possible reasons for this difference: a greater amount of reading, reading time that extended the school day, or an emphasis on English as opposed to native-language reading. In any event, the extensive additional reading time had a positive impact on English literacy.

There are some “big shifts” in the educational conversation surrounding language acquisition and reading. Informational text must be studied in addition to literature. Text complexity and text type is being more specifically defined to ensure consistency and rigor. Technology is viewed as more than a tool; it changes reading and writing instruction. Current standards, curriculum, and instructional practice have not done enough to foster the independent reading of complex texts so crucial for career and college readiness, particularly in the case of informational texts (Wick, 2011). However, fluency, vocabulary building and increased comprehension are still a piece of the reading and language instructional model.

Fluency. If the alphabet can be considered one of humanity’s greatest accomplishments, then the human brain’s ability to learn to read alphabetic writing with fluency can be considered one of its greatest achievements (Cassidy & Cassidy, 2005).

Fluency is an essential component of successful reading, along with vocabulary and comprehension development. Fluent readers know the majority of the words automatically and can better attend to less frequent words in text. Fluency serves as a bridge between word recognition and comprehension. Because fluent readers are able to identify words accurately and automatically, they can focus most of their attention on comprehension and make connections among ideas in the text and between the text and their background. In other words, fluent readers can recognize words and comprehend at the same time. Reading fluency is also associated with reading in phrases, with appropriate intonation and prosody – fluency is reading with expression (Allington, 2006).

Less fluent readers must focus much of their attention on word recognition, reading word-by-word, sometimes skipping or repeating words. They often group words in ways they would not do in natural speech, making their reading slow and choppy (Dowhower, 1987). Non-fluent readers devote less attention to comprehension (National Reading Panel, 2000). Thus, the aim of fluency practice is to increase the automatic response of struggling readers to the words that account for the majority of the words in a written text. Fortunately for the instruction of fluency, a very small group of unique words account for the majority of the total words in written language (Adams, 1990). In addition, a small group of vowel patterns appears consistently in many common words that appear in texts written for less mature readers (Wylie & Durrell, 1970). Adults' reading fluency can be improved using repeated readings of texts or reading the same text multiple times (Kruidenier et al., 2010). Instructional procedures to improve fluency can

produce important results, but they appear to do so as one part of a reading program, not as stand-alone interventions (National Reading Panel, 2000).

English language learners, students with dyslexia, beginning readers, and students reading below grade level can benefit from assisted reading (Palumbo, 2005). In recent years, a number of computer programs, including text-to-speech computer software, have been developed to provide students with repeated reading practice in order to improve fluency. In general, these programs use speech recognition software and immediate feedback as students read text on a computer screen. Computer-assisted reading has been found to be effective in improving fluency, as well as word recognition and comprehension in first- through fourth-grade students (Mostow et al. 2003). Text-to-speech computer software programs also allow students to hear the phraseology of reading and expression of the written word.

Vocabulary. Research suggests that adults can improve vocabulary through effective instruction, including the opportunity to use new words many times and process them deeply (Kruidenier et al., 2010). For a considerable percentage of children and adult learners, vocabulary is acquired incidentally (Neuman & Koskinen, 1992), as a by-product of reading (Huckin & Coady, 1999) or listening (Nagy, Anderson & Herman, 1987). This provides at least three benefits for language learners: a richer grasp of the contextual meaning and use; the concurrency of the two activities (reading/listening and vocabulary learning); and a more learner-centered learning process.

Many current electronic resources make vocabulary more comprehensible to learners (Jones, 2007). Indeed, one of the recent developments in making vocabulary more comprehensible to readers is the use of computerized glosses (glossaries) or

annotations. Roby's (1998) taxonomy of the present types and significance of glosses in teaching serves to depict the different layers of such teaching aids. In fact, researchers are investigating the different types of glosses and their usefulness (Yoshii, 2006).

Among Japanese university students, glosses in the texts helped participants retain more vocabulary compared to when they worked with texts containing no modifications

(Watanabe, 1997). Kurzweil text-to-speech software provides students with individual word access to highlighted glossed words. Students are instructed to use the computer mouse on the word, and a spoken definition and pronunciation for the word is provided.

Advanced learners of French as a second language who used this technique had higher vocabulary gains and reading comprehension was not impaired (De Ridder, 2002).

Vocabulary knowledge is extremely important in developing reading comprehension ability (Kruidenier et al., 2010).

Comprehension. Reading comprehension is a process in which the reader constructs meaning from and interacts with text in a purposeful and active manner (Harris & Hodges, 1995; Snow, 2002). Although it has always been an important element in reading and language arts, there is a growing awareness that reading comprehension is required for learning in all content areas (Duffy, 2003). Improving reading comprehension across the curriculum can be considered a strategy for improving student achievement. Most adults in adult education programs have poor functional literacy comprehension achievement (Kruidenier et al., 2010). Although the students may be able to perform simple comprehension tasks such as reading recall from simple stories and locating single pieces of information, they are unable to combine information from longer or more complex texts.

Specific strategies for improving comprehension are just beginning to be identified. The explicit instruction of cognitive strategies, opportunities to interact with a wide range of text formats, and opportunities for collaborative activities contribute to the development of reading comprehension. Cognitive strategies are processes that successful independent readers use to create meaning with text. When instructors provide explicit instruction in cognitive strategies, students, especially low-achieving ones, make significant gains on measures of reading comprehension over students trained with conventional instructional practices only (Duffy, 2003; Snow, 2002). Motivation and engagement improve with explicit strategy instruction, use of interesting texts written at a range of reading levels, opportunities to discuss questions that arise from reading, and having some choice in what is read and the questions that are explored (Biancarosa & Snow, 2004). Students need many of the same skills for constructing meaning with electronic text that they need for use with traditional text such as vocabulary, structures, and integrating information (Kim & Kamil, 2003).

Despite the importance of traditional reading skills in the reading of electronic text, one of the major reasons for the exaggerated decline of reading in young people (18-34 years of age) is they have grown up in the digital world (Prensky, 2010). The digital generation has always known computers, digital video, cell phones, video games, the Internet, and online tools. They think and communicate in different ways than any previous generation (Jukes et al., 2010). They live in a world where everything changes rapidly – daily and exponentially. Digital learners scan pages, look for keywords and phrases, and may skip long passages of text completely. This trend can be counterbalanced by redoubling effort to foster a love for reading and include visuals in

the teaching of digital learners (Naisbitt, 2006). Students want to learn in ways that are meaningful to them and that make sense immediately, feel that the time they are spending on their formal education is valuable, and make good use of technology (Jukes et al., 2010).

Why Literacy and Credentials Matter

Over the past century, economic growth in the United States has been tied to technological change: first, the assembly line machines of the manufacturing age, and more recently, computers and the Internet. Technological innovation and globalization have shifted the workforce away from manufacturing toward professional, managerial, technological, and high-level skills (Kirsch et al., 2007). Such change has led to an ongoing demand for more education and training (Carnevale & Rose, 2011). Relative demand for skilled labor grew by 1.7% per year from 1915 through 1950 (Autor et al., 2008). But with the long boom of the fifties and sixties, followed by the computer and Internet revolutions starting in the 1980s, average yearly growth of demand between 1950 and 2005 grew to 3.6% (Carnevale & Rose, 2011). The growing need for technical sophistication has been coupled with a reduced need for unskilled labor. These numbers show that increasing demand for more skilled workers has a long history and is not based solely on the recent history of computerization. These new positions may require some level of postsecondary education and continuing education to stay current in emerging technologies.

The populations discussed above especially need support in achieving the educational credentials and higher literacy that the workplace demands. The goal is for all students to be “college- and career-ready,” having the foundational skills and

knowledge that they need to be successful (“The Economic Value,” 2011). Thus, graduates must leave high school ready for additional education and/or training at a community college, technical college, apprenticeship, or certificate program or a four-year college degree (“The Economic Value,” 2011). In Iowa, only 31% of the 2011 graduating students who took the college entrance exam (ACT) earned overall benchmark scores showing that they were college-ready (Dooley, 2011). The rest are in need of some sort of remediation in order to be ready for college.

Reading is first among the career- or college-ready skills in which students may need additional preparation because reading provides direct access to knowledge. National data indicate that large numbers of adults aged 16 and older do not have the literacy skills to participate effectively in today’s workplace and society (Kirsch et al., 2007). The most recent large-scale national assessment of adults’ reading ability in the United States, the National Assessment of Adult Literacy, found that 12% to 14% of adults, or about 27 to 31 million people, scored below a basic level of reading proficiency (Kruidenier et al., 2010). Fifty to 60 million adults are at the basic literacy level. The best readers in this group can read high-school level material but have difficulty reading texts that are more dense and complex. This is particularly troublesome given that over 60 percent of all K-12 students in the United States score below the level considered proficient on national reading assessments (National Center for Educational Statistics, 2006). Proficiency is generally considered to be above the 40th percentile.

Reading and career-readiness deficiencies can be related to English language skills. More people came to the United States in the 1990s than in any other previous decade in the nation’s history (Wrigley, Richer, Martinson, Kubo, & Strawn, 2003). As a

result, more individuals who need to develop their English language and literacy skills are entering adult education programs. According to the most recent statistics from the United States Department of Education, almost half of the approximately 3 million students in federally funded adult education programs are English language learners (“How Many Adults,” 2006). Two-thirds of the immigrant adults from Mexico do not have a high school diploma (Kruidenier et al., 2010). The U.S. Census Bureau estimates that immigration will account for over half of all population growth by 2015 (Kirsch et al., 2007). More than half of these new immigrants will not have a high school diploma and approximately 80% will know little, if any, English. Without intervention, a decreasing proportion of the nation’s population will have sufficient education and literacy skills to participate effectively in an increasingly complex American society.

Disparities in literacy skills across racial, ethnic, birth origin, and socioeconomic groups, combined with the changing economy and demographic trends, place the United States at an economic and social crossroads, thus creating a “perfect storm” in which there is increasing need for well-educated, literate workers and a decreasing supply of them (Kirsch et al., 2007). Improving the educational literacy levels of adults will help close the gaps between key segments of the population, help to maintain U.S. economic competitiveness, and avoid further polarization of the country. Doing nothing to address the impact of the convergence of these factors will intensify the gaps in wages and wealth in the U.S. and increase social and political separation. Improving the literacy of the traditionally low-achieving group of adult learners will avert the devastating impact of “America’s Perfect Storm” (Kirsch et al., 2007).

Educational intervention is also very important for incarcerated populations in order to reduce recidivism and improve prisoners' life chances once they are released. A wide disparity exists in educational attainment between the general population and correctional populations in the United States. In 1997, approximately 18% of the general population lacked a high school diploma or a GED, while 40% of state inmates and 27% of federal inmates had not achieved either milestone (Harlow, 2003). Currently, there is a renewed interest in prison education due to escalating rates of incarceration and recidivism, and statistics revealing that less educated adults are more likely to be incarcerated than more highly educated adults (de Maeyer, 2001). Data suggest that adult education and the acquisition of the General Educational Development (GED) certificate are important milestones for the adult incarcerated population (Morison, 1992).³

³ The first GED (General Education Development) Tests were developed in 1942 to measure the major outcomes and concepts associated with four years of high school education. Initiated by the United States Armed Forces Institute (USAFI), the original tests were administered only to military personnel returning from World War II so the veterans could more easily pursue their educational, vocational, and personal goals (American Council on Education, 2008). The USAFI examination staff, composed of civilian testing experts, worked with an advisory committee established with support and cooperation of the American Council on Education (ACE), the National Association of Secondary School Principals, and regional United States accrediting associations.

The opportunity to document the attainment of high school-level skills served as a significant aid to the many service members whose academic careers had been disrupted during the war. During the 1950s, it became apparent that civilians could also benefit from the program – a need the ACE undertook to fulfill. Civilians were first allowed to take the GED Tests in 1952 (American Council on Education, 2008). From 1945–1963, the Veterans' Testing Service administered the program. In 1963, in recognition of the transition to a program chiefly for nonveteran adults, the name was changed to GED Testing Service.

The GED is broadly recognized as the basis for a high school equivalency diploma or certificate. Since 1963, the GED Testing Service has guided and directed a program that has served as many as one million candidates annually at more than 3,200 Official GED Testing Centers (American Council on Education, 2008). Testing is also provided for military personnel stationed overseas, for persons confined in correctional and health institutions, and for U.S. civilians and foreign nationals overseas. All 50 U.S. states, the District of Columbia, 10 Canadian provinces, and 3 Canadian territories use scores earned on the GED Tests as a basis for awarding high school equivalency credentials. Recent national surveys confirm that most U.S. employers and training programs treat GED credentials in the same manner as a traditional high school diploma (American Council on Education, 2008). The stability and acceptance of this national examination system make it a unique and important vehicle for assessing adult learning populations.

Examining the effectiveness of educational programs during incarceration has made it apparent that adult educational programs are effective at reducing recidivism (Bouffard, MacKenzie, & Hickman, 2000; Cecil, Drapkin, MacKenzie, & Hickman, 2000; Center on Crime, Communities and Culture, 1998; Conlon, Harris, Nagel, Hillman, & Hanson, 2008; Gerber & Fritsch, 1995; Harr, 1999; Tracy, 1998; Wilson et al., 2000). Recidivism rates decline dramatically with the completion of degree programs during incarceration (Stevens & Ward, 1997). An analysis of 60 different studies suggests that for those lacking a high school diploma, education while incarcerated was linked to lower rates of recidivism (Flanagan, 1994). In contrast, recidivism rates were found highest among freed federal prison detainees with less than a high school education (Beck & Shipley, 1989; Harer, 1994, 1995; Jancic, 1998). Parole success also has been linked to higher education levels (Sims & Jones, 1997). In Iowa, 522 prisoners received their GED in 2010 (Baldwin, 2011).

Inmates who successfully attain a GED gain a better chance of not re-entering the prison system because achieving this goal puts them on a more equal level with other high school graduates when searching for a job (Brewster & Sharp, 2002; Fabelo, 2002; Harer, 1995; Norris, Snyder, Riem, & Montaldi, 1996; Nuttall et al., 2003; Steurer & Smith, 2003). Offenders who had few educational opportunities previous to incarceration might have turned to crime in order to survive (Wade, 2007). Offenders typically come from impoverished backgrounds: the personal monthly income of 63% of incarcerated inmates in state prisons was less than \$1,000 per month before their arrest (Harlow, 2003). Higher poverty rates are correlated with higher crime rates (Cecil et al., 2000). The structure of an impoverished community facilitates maturing adults' involvement in

a culture of crime (Elijah, 1998). Since a lack of education may lead to poverty and crime, or crime and poverty may lead to a lack of education, prison education is justified either way. If the goal of prison education programs is to better society as a whole, then they must be rehabilitative in order to enable inmates to secure employment upon release, thereby reducing poverty generally, giving individuals an opportunity to become contributing members of society, and reducing recidivism.

GED program completion provides a greater chance of economic survival and successful reintegration into society for male and female offenders alike (Flanagan, 1994), and women may especially benefit from completion of the GED program while incarcerated. Although women comprise a smaller percentage of prisoners, in the past decade the incarceration rate of women has increased. Educational programming has focused on supporting the stereotypical female (Schram, 1998). A stereotypical American female is one that conforms to the cultural norms placed upon a female; she usually has a passive role compared to that of a male counterpart, maintains a household and cares for children. In some cases, prison education programs may have been vocationally oriented, emphasizing maintenance of the prison more than reentry into society (Winifred, 1996). A majority of female offenders have children and some have dropped out of high school to meet their children's needs – both financial and social. Those who use the prison experience to their benefit by getting a GED also provide themselves with the needed tools to stay out of prison (Brewster, 1999; Fabelo, 2002).

Thus, education is a critical component of an overall plan for the rehabilitation of offenders. Every degree or certificate that a student earns translates into improved opportunities for employment and a greater likelihood of success in the outside world

(Conlon et al., 2008). The benefit of raising standardized test scores without actually completing a program may not be as strong (Miller & Grossi, 1998).

High incarceration rates and restricted budgets are leading policy makers to assess the effectiveness of existing education programs in the prison population (Jancic, 1998). With increasing numbers of the American population incarcerated, researchers and corrections officials alike are exploring ways to reduce the likelihood that offenders will return to prison once released (Brewster & Sharp, 2002). In February 2011, Iowa Director John Baldwin, Justice System Appropriations Subcommittee member, reported that in 2009 –2010, 25% of adult arrests resulted in prison or probation sentences (Baldwin, 2011). In Florida, a 4% reduction in recidivism between fiscal years 1997 and 1999 resulted in almost \$65 million in avoided costs to victims and criminal justice (Conlon et al., 2008). The state of Iowa stands to save a great deal of money by investing in prison education; the current Iowa incarcerated population reached an all-time high in November of 2010 with nearly 9,000 prisoners. Corrections systems are under extraordinary stress with capacity limitations, decreased prison personnel, and budget constraints. “If policies and practices remain the same in Iowa, the prison population is projected to reach approximately 10,409 by June 30, 2020, an increase of 21% over the next ten years” (Baldwin, 2011). Iowa’s corrections spending per capita ranks 49th out of the 50 states, yet it bore the third largest decrease in corrections appropriations for fiscal year 2011 (Baldwin, 2011).

Policy makers and prison administrators should place a greater emphasis on obtaining a GED while incarcerated (Brewster & Sharp, 2002). Research findings have led to programs that require active participation in prisoners’ own rehabilitation. In this

model, prisoners are expected to demonstrate behavioral changes (Allison, 1993). In general, the largest decline in recidivism was found among a prison population of nonreaders when they were able to achieve a functional reading level (Fabelo, 2002). Therefore, it is critical to identify the best strategy to maximize any potential positive impact of prison education on recidivism and employment as well as to identify those with the most potential to benefit from educational opportunities while incarcerated. There is evidence that increased education is associated with reduced recidivism; however, the exact cause-and-effect relationship has not been determined.

How, then, can remedial educational programs best serve offenders and society more generally? Text-to-speech computer software is particularly promising in the improvement of reading skills for younger adults who are generally accustomed to the use of electronics in every aspect of life. Text-to-speech software supports learners who do not decode or comprehend well enough to read text independently. One of the greatest problems that poor readers face is a deficit in background knowledge in many subject areas. Students may be freed from the stigma of failure by using text-to-speech computer software (Hasselbring & Goin, 2004). Computer synthesis is effective in beginning instruction of basic phonics skills, remediation, and as an aid in reading text (Olson, Foltz, & Wise, 1986; Olson & Wise, 1987, 1992; Wise & Olson, 1989). A variety of teachers have published reports on the use of text-to-speech that present a positive picture of its effectiveness and also provide guidelines and suggestions (Olson & Wise, 1992).

Text-to-speech reading tools display text from computer memory on the computer's monitor and use a synthesizer to convert text into speech. Text is highlighted

on the monitor as it is spoken. Speech synthesis, an automatic creation of speech waveforms, has been in developmental design for several decades (Seegers, 2001). The latest advances in speech synthesis have included wider synthesizer production with very high precision. While the sound quality and genuineness still remain problematic, the accuracy of the character recognition and the fidelity of speech produced by the synthesizer are better than that of earlier text-to-speech technology (Kurzweil Educational Systems, 2005).

Most research on the use of computer speech synthesizers for reading instruction, remediation, or compensation has focused on children. For example, text-to-speech has been used to make talking books on science themes for first graders. At the end of the unit, and even well into a different study, these first graders retained the knowledge that they had gained and began to understand their personal learning patterns (Howard, 2004). Text-to-speech was also used successfully with special education fifth- and sixth-grade students with learning and emotional disabilities. The teacher of these students said, “I like it because low-level readers can access important information for research as well as read and listen to classics and other literature they could not otherwise read” (Seegers, 2001, p. 35). A study of middle school children with dyslexia found that the experimental group as a whole had significant increases in reading comprehension when using a computer reader (Elkind, Cohen & Murray, 1993). Even though most children had enhanced reading comprehension test scores, some with even very large gains, not everyone benefitted, and some even experienced degradation in reading. Yet many children reported enhanced reading speed, and it was observed that many were able to

attend to a reading task longer when using the computer reader than when reading unaided (Elkind et al., 1993).

Commercial systems, like the Kurzweil 3000 used in this study, provide this basic capability together with functionality that allows a user to tailor the system to learner needs. Kurzweil Educational Systems' Kurzweil 3000 presents an image of an actual page with pictures, graphics, page layout, and text formatting faithfully reproduced on the computer monitor. The text on the page is highlighted as it is spoken by a computer voice synthesizer. Study tools that enhance the reader's ability to discern meaning from the text and to read critically are provided: A user can select a single word from a body of text to have it pronounced, decoded into syllables, and defined. A user may also select the speed at which the text is spoken, the voice pitch and quality, the type of highlighting (on word, phrase, line, or sentence), and how much text is spoken without pausing (word, phrase, sentence, paragraph, or entire document). The Kurzweil system is coupled with a scanner and character recognition software so that the text from a printed page can quickly be transferred into a computer and then read aloud (Kurzweil Educational Systems, 2005). Developers of the Kurzweil 3000 state, "Technology like Kurzweil 3000 can make a significant difference in supporting the development of decoding and fluency skills, as well as provide meaningful access to curriculum materials" (Kurzweil Education System, 2005, p. 17).

Studies involving the Kurzweil 3000 have indicated its effectiveness in improving reading skills for students who have reading disabilities. The Iowa Text Reader Longitudinal Study 2006-2007, the work of a collaborative team across the state of Iowa (Hodapp, Rachow, Judas, Munn, & Dimmitt, 2008), hypothesized that use of Kurzweil

3000 as an accommodation would improve student access to core content through improved fluency and comprehension. This study of 20 middle school special education students and nine teachers collected biweekly progress monitoring data for 27 weeks using curriculum-based measures of fluency and comprehension. A six-hour refresher training session for teachers was provided, along with continual local training for teachers and students who participated in the study. The results documented that students accessed information twice as fast and performed significantly better on passage comprehension measures when accommodated with the Kurzweil 300 text-to-speech than when not accommodated. Overall, use of the text-to-speech software significantly affected fluency and comprehension on both recall and inferential questions. The results were both statistically and educationally significant, demonstrating that students could access core materials at twice the rate, with understanding at higher levels of thinking, allowing them to work competitively (Hodapp et al., 2008). In a study with college students, no significant differences in reading comprehension test scores were reported between unaided reading and reading done with the aid of a speech synthesizer (Higgins & Zvi, 1995). The study did find a negative correlation between the difference of aided and unaided scores with students of varying reading abilities, indicating that the greater the reading disability, the more a speech synthesizer improved comprehension scores.

Another study investigated the use of a text-to-speech computer software program in the workplace and for work-related reading (Elkind, 1996). The objective was to determine practical benefits and problems associated with the use of this technology in work-related settings, the settings in which it could be effectively used, and the characteristics of individuals who would benefit from it. It proved difficult to locate

adults who were seriously interested in using the system. It seemed that people would identify themselves only when they were in a period of transition or crisis in their jobs or lives. The crisis apparently made them focus on their reading disability and the problems that it was causing. In the absence of a crisis few people seemed willing to improve their skills or even to identify themselves as learning disabled.

Five factors that appear to be most important for successful use of technology to enhance reading include (Elkind et al., 1993):

1. Strong personal motivation to improve reading and thereby job or academic performance: The technology is not trouble free and it takes commitment of time and effort to use it successfully. Unless the motivation is strong, the system will not be successful.
2. Reading is a substantial part of the day. If it is not, gains in reading will not be important and time spent preparing materials and organizing work around the equipment will not be justified.
3. Materials are easy to prepare for use with the computer reader: Scanning simple, well-printed text is usually fast and accurate. Text that has a complex format or that is of poor quality can take a long time to scan and edit so that it can be read accurately. If it takes too much time, the cost of using the system will outweigh the benefits.
4. Sufficient time to use the system and prepare the materials: If the school situation is too demanding and does not allow adequate time to use technology, it will not be successful.

5. Supportive environment at work, home, or school: The environment must be encouraging and adaptable to the needs of the technology. At school, it is important to be able to obtain text materials in advance so they can be scanned early. Also, there must be space for the equipment. There should be no embarrassment associated with using this kind of assistive technology.

When these conditions are satisfied, text-to-speech computer readers can be an important compensatory tool for adults with dyslexia, a tool that allows them to read at a level more commensurate with their intellectual ability and that can help them attain their goals (Elkind, 1996)—even more so in the future as this technology becomes more “user friendly” and less expensive.

A recent research project using case study data demonstrated that supported access to computer-based assistive technology for adult education students with learning disabilities provided an enriched and empowered learning environment through multi-sensory, intense engagement with print and opportunities to make personal connections to a standard curriculum (Silver-Pacuilla, 2004). Text-to-speech and voice recognition assistive technology afforded students new avenues of expression and assisted them to create improved written communication. The technology not only improved reading skills, but writing too. The participants told of increased self-determination and goal-directedness as well as increased independence in literacy tasks in daily life (Silver-Pacuilla, 2004). This study also demonstrated that assistive technology can help adult students with learning disabilities access content material through frequent exposure, intensity of one-to-one interaction, and explicit, multi-sensory guided practice and feedback. Supported access can also improve computer skills necessary in the global

workforce. However, students entering adult education programs may not report a specific learning disability other than to say that they find reading difficult or they attended special education classes when they were in school.

Elkind (1996) interviewed adult students who did not like text-to-speech computer software and who chose not to participate in a study. The participants cited a variety of reasons for not using the text-to-speech program: unintelligible voice quality, lack of perceived enhancement in reading performance, too cumbersome to operate, too much sensory input, not enough time, not “normal” enough. In addition, some adult learners felt it was “cheating” to use it, and they wanted to read on their own. Many participants did favor the computer-based program: the technology allowed learners to read age-appropriate materials; provided a wider choice of materials; helped students progress more rapidly through access, practice, and reinforcement; enabled students to do more reading; built self-esteem; and gave access to independent reading. Participants who gained the most from using the technology had poor unaided reading rate, comprehension, and endurance (Elkind, 1996). The adult learners had to be able to integrate auditory and visual integration to make gains in reading performance. The research found that attention to text, as measured by distractions during reading, improved 54% using the text-to-speech format. Also, time spent reading passages decreased by 29% when the text-to-speech was used (Elkind, 1996).

While assistive technology is valuable, improved learning for all students depends on the quality of instruction – not the medium with which it is delivered. “Instructional technologies are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes change in our

nutrition” (Clark, 1983, p. 445). The Comprehensive Adult Student Assessment System (CASAS) is used in adult education classes and training programs to measure student learning gains in reading. This assessment system can help educators to understand whether particular instructional methods are effective. CASAS consists of multiple-choice test items that can be administered as pretest and posttests across a range of student ability levels in a life and work skills context.

The CASAS is the most widely used system for assessing adult basic reading skills within a functional context and is approved and validated by the U.S. Department of Education and the U.S. Department of Labor to assess both native and non-native speakers of English (Comprehensive Adult Student Assessment System, 2008). The CASAS is backed by more than 25 years of research and development in adult assessment by addressing core indicators of performance and the effectiveness of adult education and literacy programs (Comprehensive Adult Student Assessment System, 2008). The first CASAS test forms were created in 1981. New tests have been created over the ensuing years to expand or strengthen the CASAS assessment system. As test items are developed, they are placed in an item pool, from which new multiple-choice test forms and modes for delivery are constructed. Results from most CASAS tests are reported on a common numerical scale that has been verified and validated on more than three million adult and youth learners (Comprehensive Adult Student Assessment System, 2008).

Bias and sensitivity reviews of all CASAS items are conducted to ensure that the performance of an examinee is based on construct-relevant factors and not construct-irrelevant factors or group classification characteristics such as gender, ethnicity, or

native language. CASAS uses specific guidelines for bias and sensitivity reviews as recommended by CASAS psychometricians (Comprehensive Adult Student Assessment System, 2010). The parallel forms that comprise the reading assessments are constructed so the two forms can be used independently of each other and are considered equivalent measures. The overall test score correlation of the 2,256 examinees who tested with parallel forms is .81, i.e., 66% of the variation in performance on one parallel form of the test can be accounted for by scores on the other parallel form of the test. Nearly 91% of these examinees had a test score correlation of .89 excluding outliers (Comprehensive Adult Student Assessment System, 2010).

The CASAS is used in all community college adult education programs in Iowa, including those offered in Iowa's prisons. Iowa administers its adult basic education programs through the state community college system. Iowa uses an integrated community college delivery system that provides the delivery of adult basic education and literacy services outlined in Section 231(b) of the Workforce Investment Act (Working for America Institute, 2010). Adult basic education and literacy services are offered in all 15 of the community college districts in Iowa. Each of the 15 districts also coordinates and subcontracts the provision of services with other literacy partners within their district. Iowa is able to use this system successfully, in part because of the consistent boundaries set across provider types and across geographies (Rickard, Stiles, & Jacobsen, 2003). Overall, adult education is a relatively small percentage of the total enrollment of community colleges: in 2001-2002, Iowa had 19,367 students enrolled in federally funded adult education (Rickard, Stiles, & Jacobsen, 2003). The largest enrollment appeared within the 25-44 age group followed by the 19-24 age group; 16.1%

were at the Adult Secondary Education (ASE) level (220-236 scaled score) as assessed on the CASAS (Rickard et al., 2003). In Iowa, between 51% and 55% of the ASE students will advance a level when given a CASAS posttest (Rickard et al., 2003).

Professional Development for Instructors

Although a variety of factors contribute to the disparities in academic performance that correspond to race and class background, the need to provide teachers with requisite skills to teach effectively, regardless of race, class, and culture, is now widely recognized as essential (Boykin & Noguera, 2011). Concerned teachers are continually requesting more training and additional professional development using technology (Prensky, 2010). Teachers need to know how students can and should use technology to enhance their own learning. Using technology is the student's job, while the teacher coaches and guides the use of technology for effective learning (Iowa Department of Education, 2011b). The greatest single boon of the arrival of digital technology in our schools is that it could, in the long run, enable teachers and students to partner in a personal and individual way with the teacher acting as coach and guide (Kelly et al., 2009).

The successful use of technology in classrooms requires a partnering of teachers and students, creating a community of practice known as a blended classroom (Wenger, McDermott & Snyder, 2002). From 2003-08, high schools in Metropolitan Nashville Public Schools (MNPS) consistently failed to meet Annual Yearly Progress (AYP). In 2009, MNPS introduced blended learning, and that year all the district's schools not only met AYP, but also went from a 58% to a 72% graduation rate (Varlas, 2011). The study provided evidence that blended classrooms enabled students to engage in discovery, find

evidence to support claims, create and share examples, and communicate with peers and writers around the globe using technology, thus causing an increase in student success.

Important changes required of educators today are not technological, but rather conceptual: educators must think of themselves less as guardians of the past and more as partners, guiding their students toward the future. Not all adults entering an adult learning center are digital learners. The use of text-to speech computer software provides the opportunity for adult learners to become familiar with the technological world by advancing computer skills and providing opportunities to learn in a digital environment. This is a part of being college- and/or career-ready in the world today.

High-quality instruction is essential to foster student retention and produce successful outcomes. But salaries for adult educators are low, and many positions lack benefits. Adult educators are not given paid planning time or collaborative opportunities to create meaningful professional learning communities or communities of practice. This limits the pool of potential instructors and leads to high turnover (National Commission on Adult Literacy, 2008). While many adult education instructors are credentialed for K-12 teaching, few states require that adult education teachers show mastery of the specialized skills needed to teach adult learners (Crandall, Ingersoll, & Lopez, 2008; Schaetzel, Peyton, & Burt, 2007). Moreover, states have not established certification systems to ensure that all instructors have this ability, and the majority of adult educators nationwide are working part-time, often as a second job (Peterson, 2009). This is another clear sign that adult education is not considered a serious profession (Crandall et al., 2008). Lack of high-quality instruction is of concern for all students, particularly adults with learning disabilities and other special education needs. Adult students are not

typically assessed for specific learning disabilities; thus, teaching and learning strategies are not employed for specialized remediation.

The situation of the classroom that constitutes the workplace for teachers can be terribly isolating. The process of innovation is such that teachers need each other if they are to sustain change (Joyce and Showers, 1995). Also, in most teaching and learning settings there is a little time to acquire new teaching skills, implement them with fidelity, and reflect on the new teaching models or innovations. Without companionship, help in reflecting on practice, and instruction on fresh teaching ideas, most educators can make very few changes in their behavior, however well-intentioned they are (Peterson, 2009). Educators in the adult learning environment lack professional development, time to reflect on practice, and collaboration with other educators working in the field of adult education.

How professional development helps. A professional development study was completed to better understand how Adult Basic Education (ABE) teachers change as a result of participating in professional development (Smith & Hofer, 2003). Teachers who made instructional changes as a result of professional development were influenced by complex interactions between individual factors like (a) educational background; (b) motivation; (c) years of teaching experience; (d) professional development factors; (e) number of hours of professional development attended; and (f) the quality of the experience. In addition, program/system factors, such as access to paid preparation time, benefits, and colleagues, and input to decision-making in the program, were also critical to change. Teachers felt they needed to be better supported if they were to provide high-quality instruction and services to students. Teachers would like support in the form of

paid prep time and paid professional development release time (Smith & Hofer, 2003). An improvement plan for teacher preparation and working conditions starts with policymakers in programs and states attempting to provide support, professional development, access to colleagues and input on decision-making.

A number of educational innovations, all of which seemed basically good when promoted, have not endured the test of time (Cuban, 1987). Some innovations require changes that are gradual and subtle; others require changes that are dramatic. Gradual and easy change is first-order change, and dramatic and deep change is second-order (Fullan, 2001). First-order change can be thought of as the most obvious step to take in a school setting. Second-order change is something deemed more difficult. It involves dramatic departure from the expected, both in defining a given problem and finding a solution (Marzano, Waters, & McNulty, 2005). Some educators find second-order change to be acceptable and easy but only when they deem the change to be necessary for improved learning for students. Professional development for blended learning is evolving, and a potential area for huge growth in the next decade (Varlas, 2011).

There are numerous alternative ways to understand change theory. For example, another method of classification describes Type I, Type II, and Type III problem/solution changes (Heifetz, 1994). Type I problems are those where there is a reasonable expectation that traditional solutions will suffice. Type II problems are those that might be well defined, but there are no clear-cut solutions available. Type III problems are those for which current ways of thinking do not provide a solution. Type I and Type II problems typically require first-order change, whereas Type III problems require impressive change, sometimes called second-order.

A common human response is to address virtually all problems as though they were first-order change issues. It makes sense that educators would tend to approach new problems from the perspective of personal experiences – as issues that can be solved using prior solutions. This human tendency could be called a retrieval of a mental map (Argyris & Schon, 1974). Individuals and organizations have mental maps regarding how to act in certain situations. New insights fail to get put into practice because they can conflict with deeply held internal images, mental models of how the world works, and images that limit thinking and acting (Senge, 1990). These models must be managed through continual surfacing, testing, and improving internal pictures of the working world. When faced with a new situation, educators will consult their own personal mental map (mental model) to find a solution. Unfortunately, solutions to some of the recurring modern-day problems require a second-order change. “The big problems of the day are complex, rife with paradoxes and dilemmas; for these problems, there are no once-and-for-all answers” (Fullan, 2001, p. 73).

Change is not happening quickly enough in education because change strategies are based largely on the development and dissemination model (Henderson & Dancy, 2007). Educational researchers develop and test specific innovations and disseminate the results to instructors. The educators might be told that the methods they currently use are ineffective and the researchers will introduce evidence for alternative practices in the hopes that instructors will adopt them in their classrooms. This approach fails to consider contextual factors that influence practice and the ability to change. The instructors appear to want to be part of the solution, rather than mere targets of the research. A more fruitful approach might be to collect knowledge from both inside and outside the

community to develop better change models and collect empirical data on the effectiveness. There is a need to advance the conversation about reform.

Conclusions and Summary

Adult education programming is struggling. Improvements are made, but they do not seem to last. Reform efforts in the world of adult education are not embedded in educational best practice. The students in the adult learning programs are fragile; they are in need of methodologies and strategies that create a haven where learning can be systemic, relevant, collaborative and possible. Moreover, research into past and current practice paves the way for technology to take its rightful place in the education of all low literate adults. In the future, all members of the populace must be digital learners, with capacity to produce, create, solve, and enjoy the benefits the culture has to offer. The ability to read fluently and derive meaning from written text is fundamental in sustaining a 21st century world in which everyone contributes. Furthermore, the economy requires workers who are trained and educated as members of a complex society of contributors. The poorly prepared do not have a place in this economic landscape. The adult population must be literate and able to create and sustain a culture that is vibrant, reflective and democratic.

Chapter Three

Method

As Chapter 2 described, the literature clearly points to the potential of text-to-speech adaptive technology to help learners improve literacy and achieve credentials necessary to improve their life chances. The research questions at the heart of this study are

1. Does text-to-speech adaptive educational technology improve low-literate incarcerated adults' reading competency scores?
2. Does adaptive educational technology improve low-literate incarcerated adults' reading competency scores differently by (a) age, (b) gender, (c) ethnicity, (d) ELL status, or (e) initial literacy level?
3. How do low-literate incarcerated adults and teacher/adult mentors explain their level of satisfaction (like or dislike) with the adaptive educational technology?

The best approach for answering these questions is using quantitative research methodology, a way of testing objective theories by examining the relationships among variables measured on instruments, so that numbered data can be analyzed (Creswell, 2009). This study uses several different quantitative methods to answer the research questions. First, it applies the *t*-test, a parametric test used to see whether a difference between the means of two samples is statistically significant. The *t*-test produces a value for *t* which is matched against a statistical table to determine the level of significance that has been reached. If the level of significance is less than .05, the null hypothesis is

rejected and a real difference exists (Fraenkel & Wallen, 2000). The independent samples *t*-test is used to compare the same group before and after using the Kurzweil 3000 computer text-to-speech software on the computers located at the prison sites. Second, this study uses descriptive statistics to provide summaries about the sample and measures. Each variable is described with a frequency distribution, a central tendency distribution, and dispersion around the central tendency. Third, study participants responded to open-ended questions which were analyzed and used to deepen understanding of the results from this pre-experimental study.

This study enhances the conversation surrounding educational usage of text-to-speech computer software among adult learners in an incarcerated environment. The study results and analysis of data acknowledge the use of this form of adaptive technology and a shift of teaching and learning practice may result. The epistemological study does not require complete fidelity because that would preclude innovation; rather, it focuses on the existence of meaningful entities independent of consciousness and experience (Crotty, 2004). The use of text-to-speech software is being used for the first time and is innovative at both of the prison sites segregated by gender. The outcomes of this study are suggestive rather than conclusive. As with any postpositive study such as this, human knowledge is conjectural and can be modified or withdrawn with further investigation (Ozmon & Craver, 1999).

Empirical research based on experimentation or observational evidence is used to test a hypothesis. Empirical data for this study were produced by experiment, surveys, and interviews. The objective was to capture contextual data and identify and learn from

the collective experience of others from the field. This work promotes an environment for improved understanding.

Methodological Approach

The study design is pre-experimental. This design includes a pretest measure followed by a treatment and a posttest for all adult incarcerated students in the study.

Sample Population 01 _____ X _____ Sample Population 02

With pre-experimental designs, the researcher studies a sample population without a control population and provides an intervention (X) treatment during the experiment (Creswell, 2009). All students entering the Midwest Central Area Community College (MCACC) Adult Literacy preparation program (prison system included) take a CASAS (Comprehensive Adult Student Assessment System) pretest in literacy competencies. The students were then placed at an instructional level labeled as an adult secondary education (ASE) level. Sample Population 01 was a group of 24 incarcerated adult low-literacy students scoring within the range of 220-238 on the CASAS literacy competencies assessment. CASAS labels this group with an instructional level of Adult Secondary Education (ASE); thus, the sample population will begin instruction at a pre-GED level. However, this score is only used as a predictor of GED literacy readiness, and formative measures are employed to assess accurate placement of students for instruction. The range of scores, as listed above, signifies a need to begin using instructional curriculum at a pre-GED level.

The X, or intervention treatment, is the engagement with the text-to-speech computer software program, Kurzweil 3000, for students scoring within the range of 220-

238 on the CASAS pretest. Engagement is the mental effort (time) focused on learning progress (Beder, Tomkins, Medina, Riccioni, & Deng, 2006). The present study focused on how the learning context shaped engagement, for a very practical reason: to a great extent educators control the educational content. Identical curriculum materials are selected, purchased and used by all adult learning centers in this state. Thus, if it is understood how the educational context shapes engagement, engagement can influence positive learning outcomes.

Students are generally administered a posttest (CASAS) at the end of each 40-hours of instruction as required by the state Department of Education. In this study, the CASAS was administered at the conclusion of the study, regardless of the 40-hour benchmark. Each student's time spent using the software was used in the analysis of data. The Sample Population 02 in the above diagram represents the posttest score mean on the CASAS.

Participants and Sampling

This study is part of a larger, ongoing research project in collaboration with the University Adult Literacy Center. Permission was granted by Midwest Central Area Community College (MCACC) to pursue this aspect. MCACC administers all programs across the state in multiple locations, including prisons. Permission for the study was obtained from the University Institutional Review Board (IRB).

The present study involved pretest data that had already been gathered; all students take the CASAS pretest upon entering the prison's educational system. This pretest is considered valid (Comprehensive Adult Student Assessment System, 2010). Current validity theory reiterates validity as a unified concept that relies on multiple

sources of evidence when evaluating the use and interpretation of scores (Kane, 2006). The relationship of CASAS to the 2002 official GED Test was examined using data from California, Iowa, Oregon, Kansas, and Hawaii (n=4,801). CASAS reading scores were collected along with official GED test results from the participating states. A relationship was found between CASAS reading scores and GED reading scores; a similar relationship was found between CASAS reading scores and overall GED results averaged across the five tested content areas (Comprehensive Adult Student Assessment System, 2010). The field results of the California High School Exit Examination (CAHSEE) Readiness Test for the English Language Arts provides further evidence of the construct of reading assessments and the items in the CASAS item bank (Comprehensive Adult Student Assessment System, 2010).

Five Kurzweil software licenses were purchased for students at each of the two prison sites segregated by gender (for a total of ten licenses); each center had a total of five computers with GED and pre-GED curricula scanned and downloaded. The teachers at each of the two prison sites agreed to help students in a blended classroom environment (direct instruction, coaching, and technology applications). Prior to implementation, teachers at each prison site were given a 3-hour training on Kurzweil 3000. The training included the technical aspects of using the application and software features available for students. The “prisoner mentors” at the prison sites were given Kurzweil training along with the prisoners when the study began.

To begin implementation, as a group, all Adult Secondary Education (ASE) students were given an overview of the project at each prison site. Students interested in being part of the study met individually with the researcher who gave them an

opportunity to sign a consent form and to collect personal data. All students (study participants and non-participants in the study) were given a tutorial on the text-to-speech software. Students in the study were instructed to keep a time log as they worked through the lessons on the computer. An alternate form of the CASAS test assessing literacy competencies was administered to all remaining subjects at the conclusion of the study. Individual student time logs were also collected at that time.

Sixteen students at a Midwest correctional facility for men and 26 students at a Midwest correctional facility for women agreed to be a part of the study. All consent forms and data collection forms were gathered and put into a locked file cabinet at the University Adult Literacy Center. Prisoners with an educational component to their rehabilitation plan are required by the state to be in adult education classes two hours per day. However, prison release dates, personal conduct of the inmates, scanning and technology issues, and motivation influenced the final participation rates for this study.

Data Collection Methods

The CASAS pre-assessment is given to all students entering an adult learning program. The assessment is a non-timed, 31-item multiple-choice battery of questions that provides a literacy competencies scaled score for each student (Comprehensive Adult Student Assessment System, 2008). Adults entering the program with a pretest score between 220 and 238 were eligible to be a part of the study. This score indicated a need to work with pre-GED materials rather than GED curriculum. Adult learners at the instructional ASE level were invited to participate in the research and spend time working with the text-to-speech reading software program. The expectation for students was to increase fluency, comprehension, and vocabulary skills so that they could begin

working with GED materials that have a more advanced reading level. In a face-to-face meeting, students were given an overview of the technology, asked to complete a form providing demographic data, briefed on the program, and requested to sign a release form. All materials were taken to the University Adult Literacy Center and locked in a file cabinet.

Each individual's CASAS score at the beginning of the study (pretest) was analyzed and compared with his or her score at the end of the study (posttest). Group means were also compared and analyzed. Personal participant data (age, ethnicity, gender, and beginning scores) were collected at the onset of the study. Each participant logged personal usage time in minutes spent using the text-to-speech software. Each teacher was provided with an Excel spreadsheet for data collection.

The teachers at the Midwest correctional facility for women, using a pre-made questionnaire, collected open-ended question data in the form of written responses from students at the conclusion of the study. The open-ended questions were not asked in a face-to-face setting as time constraints precluded that from occurring. However, the researcher conducted a face-to-face interview at the correctional facility for men. The questions were identical at both sites; however, the collection of data was done face-to-face at the men's site and a written response was solicited at the women's site. The questions were IRB-approved.

The researcher sent monthly emails to the sites to offer encouragement and praise in an attempt to continue adult learner participation in the treatment. The researcher also visited each site once per month to offer guidance and help to the instructors and mentors as they worked to oversee the treatment. The participants, instructors, and mentors were

reminded of additional features of the software available for student use on the Kurzweil 3000 text-to-speech software package. The participants were reminded to keep time logs at these meetings. Teachers contributed feedback during these visits as well as through email communication with the researcher.

Data Analysis Procedures

The analysis employed in SAS was the *t*-test. A *t*-test was used to determine if there was an increase in test scores following the use of the reading technology. A *t*-test is used as the scaling term when the test statistic is unknown due to small sample size. The scaling term is replaced by an estimate based on the data and the test statistic follows a student's *t*-distribution. *T*-tests are used when the independent variable is categorical and the dependent variable is continuous. An independent two-sample *t*-test was used to determine if the posttest scores were statistically greater than pretest scores of all participants using the technology. Using the mean and standard deviations from the samples, an effect size for the use of the technology was calculated.

Also, *t*-tests were used to determine if the mean gain in score between pretest and posttests differ by age, gender, minority status, ELL status, and beginning CASAS pretest scores. In order to convert age and time spent using the technology into categorical variables, participants were divided into two groups: those with less than average (for the sample) age/time and those with greater than average age/time. Quantitative data were collected when the variable of elements were measured along a scale. Data differing in amount or degree, along a continuum from less to more, may be reduced to numerical scores or percentages (Young & Kaffenberger, 2009).

Descriptive statistics were used to describe the basic features of the data in this study. These statistics provided summaries about the sample and the measures. There are three major characteristics of a single variability description: the distribution, the central tendency, and the dispersion.

This was a quantitative study with open-ended question data collected after the posttests to help clarify and add depth of understanding to the numerical results. The open-ended questions asked were included in the approved IRB protocol and included: (a) How easy or hard was it for you to learn how to use the computer program? (b) Did you like or dislike the screen-reader for studying the provided curriculum? and (c) What could you suggest that would have helped you get better use of the computer in your studies? Data gathered through answers to open-ended questions can help to challenge status-quo thinking, reflect the equity of services and evaluate the range of belief systems (Isaacs, 2003).

Design Issues

1. There is no control group in this study because treatment was not withheld from any student who wanted to use the text-to-speech software.
2. There is no comparison group from previous data because the data were not available at the state Department of Education.
3. Random assignment to groups was not possible due to the fact that incarcerated subjects were not able to be relocated.
4. Stratified or matched samples were not possible due to low numbers in each group from the sample population.

The study sample of incarcerated adult students was based on CASAS reading assessment scores between 220 and 238. Prisoners at the two prison sites selected for this study were required to participate for a minimum of two hours per day in an educational setting located within the prison. Prison sites were segregated by gender.

Specifically, the purpose of the study was to determine if using text-to-speech computer software would have an effect on learning gains for an incarcerated population. It also set out to determine the impact of independent variables upon the success for both groups of students entering the educational program at the prisons and to understand students' level of satisfaction with the program.

The dependent variable for success was the dichotomous variable, which was coded by pretest and posttest scores on the CASAS assessment. The study sought to determine if there were significant differences in CASAS scores among subjects of different ages, genders, ethnicities, English language learning status, and beginning CASAS pretest scores.

Limitations and Delimitations

As with any research endeavor, assumptions existed in this study that related mostly to the participants and program. These assumptions were (a) the participants are representative of the adult learning population; (b) observations and artifacts are a microcosm of the teachers' typical use of curriculum and instruction; (c) participants are truthful regarding self-evaluation, actions for improving practice, and goals they promote, as opposed to reporting what they are supposed to say, despite being told the study is an

evaluation of the innovation, not the students; and (d) morbidity rates are influenced by prison release dates, personal conduct of inmates, and engagement.

Technology issues were a concern in a study of this nature. Each site had a total of five computers with the software downloaded. The number of participants at each site exceeded five so it was possible that students became disenchanted with having to wait for access to the computer and reverted to the workbooks they had been using previously. Also, at the beginning of the study, not all centers had the pre-GED study materials scanned so there was a six-week delay. When the computers did not work, there were weeks of delay until the technology specialists could assess the problem and solve it.

The study was limited to a convenience group of adult learners. It was limited in time, with only a five-month window for participation and data collection. In most settings, adults do not receive daily instruction in reading, and adult attendance was not as consistent given the nature of punitive actions in a prison setting. Incarcerated populations struggle within an environment less conducive to a safe and productive learning situation. Although participation in the research was voluntary, participation in the adult education program may be a required component of their prison rehabilitative program.

Regarding the use of text-to-speech implementation, participants from both groups had different instructors; however, the content was the same in all locations. All teachers may have good intentions, but some may not be self-assessing their understanding and practice. For example, they may convey support for educational use of the text-to-speech software, but in reality, do not have the expertise or level of comfort with the computer software to help a student become engaged with the format. Also,

issues that influence a teachers' professional practice such as community contexts, administrative policies, and teacher socialization are beyond the scope of the study. Most teachers of adult learners at the basic educational level are not actively engaged in professional development to broaden their base of understanding or implementation with technology nor advanced professional development in the area of reading development (de Maeyer, 2001).

Another limitation of the study was student support. The treatment was implemented differently between the prison sites. There were two adult mentors assisting students on the computer in the Midwest correctional facility for men. Male prisoners (mentors) were assigned to work in the education center and were able to assist the low literate adult populations with technology issues as well as content questions. There was only one adult mentor at the Midwest correctional facility for women. Also, data from the open-ended questions were collected in a teacher-administered written response format at the women's site and face-to-face collection was done at the men's site. The questions were identical; however, participants could have preferred one collection method over another, so the responses could have been adversely affected.

The sample population deteriorated in size within the five-month treatment period. Prisoners could be released, kept from the education center due to issues of poor behavior or simply lack satisfaction and discontinue using the treatment. This is typical of the low-level adult learning population (Iowa Department of Education, 2011a). However, student achievement scores are only one aspect of the analysis of student success (McNergney & Imig, 2006). While student scores may provide insight in data analysis, their absence does not dramatically diminish the present methodology's worth.

Transformation in an adult life is “owning the ability to change” one’s circumstances, moving forward, empowerment, and using transformation in many aspects of life. Even though these factors were not studied in depth, they are critical components of educational achievement. Research may attempt to isolate effective instructional approaches or aspects of effective instruction, this does not imply that only one approach should be used or that instruction should focus on only one strategy in the teaching of reading.

Chapter Four

Analysis of the Data

This chapter presents the demographic characteristics of the sample population and results of the analyses of the relationship between use of the text-to-speech computer software and literacy gains on the Comprehensive Adult Student Assessment System (CASAS) reading assessment. The purpose of this study was to determine if incarcerated adult students using Kurzweil 3000 text-to-speech computer software would achieve an increased CASAS literacy score attributable to the technology. The data in this study were gathered from incarcerated adult students who entered the Midwest Central Community College Adult Education Program (offered on-site at their detention facilities) from late fall 2010 through spring 2011 (five months). Using multiple independent sample *t*-tests, this study examined the increase in literacy scores of incarcerated adult learners at two prison facilities segregated by gender. The variables included: age, gender, minority status, English language learner (ELL) status, and beginning literacy scores on CASAS.

The objective of the study was to determine if there were any significant differences in improved literacy among a group of incarcerated adult education students after using a text-to-speech technology application in the educational setting at the prisons. Specifically, the study determined if students using Kurzweil 3000 text-to-speech computer software

1. experienced literacy skill improvement after using the text-to-speech software for five months;

2. differed in literacy skill improvement success by age, prison site segregated by gender, minority status, ELL status, and CASAS pretest score, and
3. were satisfied (liked or disliked) using the computer technology.

This study examined student score gains as measured by CASAS pretest to posttest using Kurzweil 3000 text-to-speech computer software and the impact of student demographics on success as quantified on a CASAS pretest to posttest pre-experimental design study. This study also assessed incarcerated student responses as to level of satisfaction (like or dislike) using Kurzweil 3000 text-to-speech computer software.

The number of Native American, Black, and Hispanic students was too low to apply any statistical analysis according to particular ethnicity or race, so the groups were combined in this study to form a composite minority status group. This composite minority group is larger than the group of White participants. Independent variables consisted of age, prison site (segregated by gender), minority status, ELL status, and beginning scores on the CASAS literacy assessment. Participants were attending adult education classes in their respective facilities. The data analysis for this paper was generated using SAS/STAT software, Version 9.3 of the SAS System for Windows.⁴

Of the 24 participants in the study, the median age was 34. There were 12 under the age of 34 and 12 older than 34. By prison site, there were 14 participants at the female institution and 10 participants at the male institution. When race and ethnicity were collapsed into two categories, there were 10 White participants and 14 minority status participants. Only four of the participants were ELL. The median time spent using the text-to-speech software was 167.5 minutes, with 12 participants spending more than

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167.5 minutes and 12 spending less than 167.5 minutes. The median pretest score on the CASAS literacy assessment was 228, with 12 students under 228 and 12 at 228 or higher (Table 4.1). This convenience population was located within a 30-mile radius of the researcher. This sample population is one of convenience and may not represent the whole incarcerated population (Fraenkel & Wallen, 2000).

Table 4.1

Selected Demographic Variables within Sample Population, N = 24

INCARCERATED FEMALES					
Subject	Age	Ethnicity	Language Status	CASAS pretest	CASAS posttest
F1	38	White		222	224
F2	31	White		232	241
F3	28	White		231	236
F4	33	Black		222	245
F5	65	White		227	220
F6	34	White		226	232
F7	38	Black		228	232
F8	42	White		222	233
F9	42	Hispanic	ELL	234	242
F10	28	White		234	240
F11	31	Black		219	219
F12	52	Native American		221	229
F13	50	Black		238	233
F14	25	White	ELL	224	232

INCARCERATED MALES					
Subject	Age	Ethnicity	Language Status	CASAS pretest	CASAS posttest
M1	21	Black		219	222
M2	55	White		230	224
M3	30	Black		225	230
M4	21	Black		229	229
M5	40	White		229	233
M6	46	Hispanic	ELL	226	232
M7	34	Hispanic	ELL	234	234
M8	23	Black		226	226
M9	30	Black		230	232
M10	28	Black		236	240

The academic success analysis utilized an independent samples *t*-test to determine if there was any association between categorical variables and increased scores

on the CASAS literacy assessment. The analysis addressed seven hypotheses based on increased scores from pretest to posttest. The following paragraphs state each research question followed by the data analysis that was conducted for each question. The results include those items that were relevant to the topic and whether or not they were statistically significant.

Research Questions

Research Question One. Does text-to-speech adaptive educational technology improve low literate incarcerated adults' reading competency scores?

The paired samples *t*-test determined whether there was a significant difference between pretest and posttest CASAS literacy scores when using a text-to-speech treatment with adult incarcerated populations with a low literacy level. The data were normally distributed, and therefore a paired samples *t*-test could be utilized.

H₀: No increase in CASAS literacy scores will occur when students use the Kurzweil 3000 text-to-speech computer software while attending adult education classes in an incarcerated environment.

Table 4.2 reports the results of the paired samples *t*-test. The mean score on the pretest for the sample population is 227.67 with a standard deviation of 5.36. On the posttest, the mean score of the sample population is 231.67 with standard deviation of 6.91. The standard error of the mean difference (*SEM*) is 1.26. The *t*-value (*t*) is 2.24. The *p*-value (*p*) is 0.03. The difference between pretest and posttest CASAS score is statistically significant using a *p* < .05 cut off, so the *null hypothesis* is rejected. Effect size using Cohen's *d* was calculated with the formula provided by Green and Salkind (2011) where $d = t/\sqrt{n}$, resulting in a Cohen's *d* = .46. Green and Salkind note that "*d*

values of .2, .5, and .8, regardless of sign, are, by convention, interpreted as small, medium, and large effect sizes, respectively” (p. 171).

Table 4.2

CASAS Pretest and Posttest Scores, N = 24

Incarcerated Adult Literacy Students						
Mean		SD		SEM	t	p
pretest	posttest	pretest	posttest			
227.67	231.67	5.36	6.91	1.26	2.24	0.03*

* $p < 0.05$

Research Question Two. Does adaptive educational technology improve low literate incarcerated adults’ reading competency scores differently by: (a) age; (b) gender; (c) ethnicity; (d) ELL status; or (e) initial literacy level as measured on CASAS.

Research Question Two (a), (b), (c), (d), and (e) examined variable characteristics of the combined populations at two Midwestern prison sites segregated by gender.

Research Question Two (a). Does text-to-speech adaptive educational technology improve low literate incarcerated adults’ reading competency scores differently by students’ age?

H₀: No difference in the increase in CASAS literacy scores exists between students of different ages.

Participants were divided into two groups. Those participants who were under age 34 were grouped together (0 = under 34) and the participants who were 34 or older were grouped together (1 = 34 and over). An independent samples *t*-test was run to determine if there was a difference in test gains based on age. Levene’s test for equality of variances was not statistically significant indicated equal variances can be assumed. The result of the independent samples *t*-test was not statistically significant $t(22) = 1.13, p = .27$. Table

4.3 reports the results of the independent samples *t*-test and the means and standard deviations for the two groups. The difference is not statistically significant, so the *null hypothesis* was accepted.

Table 4.3

Independent Samples t-test by Age, N = 24

Incarcerated Adult Literacy Students						
Age	<i>n</i>	<i>M</i>	<i>SD</i>	<i>SEM</i>	<i>t</i>	<i>p</i>
Under 34	12	5.417	6.30			
34 and older	12	2.583	5.93	2.49	1.13	0.27

Research Question Two (b). Does text-to-speech adaptive educational technology improve low literate incarcerated adults’ reading competency scores differently by students’ prison sites, which are segregated by gender?

H₀: No difference in the increase in CASAS literacy scores exists between students of different gender.

An independent samples *t*-test was run to determine if there was a difference in test gains based on gender. Levene’s test for equality of variances was not statistically significant indicated equal variances can be assumed. The result of the independent samples *t*-test was not statistically significant $t(22) = 1.52, p = .14$. Table 4.4 reports the results of the independent samples *t*-test and the means and standard deviations for the two groups. The difference is not statistically significant so the *null hypothesis* was accepted.

Table 4.4

Independent Samples t-test by Gender, N = 24

Incarcerated Adult Literacy Students						
Gender	<i>n</i>	<i>M</i>	<i>SD</i>	<i>SEM</i>	<i>t</i>	<i>p</i>
Female	14	5.57	7.23	2.48	1.52	0.14
Male	10	1.80	3.49			

Research Question Two (c). Does text-to-speech adaptive educational technology improve low literate incarcerated adults’ reading competency scores differently by minority status?

H₀: No difference in the increase in CASAS literacy scores exists between minority students and White students.

An independent samples *t*-test was run to determine if there was a difference in test gains based on minority status (0 = non-white, 1 = white). Levene’s test for equality of variances was not statistically significant indicated equal variances can be assumed. The result of the independent samples *t*-test was not statistically significant $t(22) = .13, p = .90$. Table 4.5 reports the results of the independent samples *t*-test and the means and standard deviations for the two groups. The difference is not statistically significant so the *null hypothesis* was accepted.

Table 4.5

Independent Samples t-test by Minority Status, N = 24

Incarcerated Adult Literacy Students						
Minority Status	<i>n</i>	<i>M</i>	<i>SD</i>	<i>SEM</i>	<i>t</i>	<i>p</i>
Non-White	14	4.14	6.49	2.61	.13	.90
White	10	3.80	6.00			

Research Question Two (d). Does text-to-speech adaptive educational technology improve low literate incarcerated adults' reading competency scores by ELL status?

H₀: No difference in the increase in CASAS literacy scores exists between ELL students and non-ELL students.

An independent samples *t*-test was run to determine if there was a difference in test gains based on ELL status (0 = non-ELL, 1 = ELL). Levene's test for equality of variances was not statistically significant indicated equal variances can be assumed. The result of the independent samples *t*-test was not statistically significant $t(22) = -.53, p = .61$. Table 4.6 reports the results of the independent samples *t*-test and the means and standard deviations for the two groups. The difference is not statistically significant so the *null hypothesis* was accepted.

Table 4.6

Independent Samples t-test by ELL, N = 24

Incarcerated Adult Literacy Students						
ELL Status	<i>n</i>	<i>M</i>	<i>SD</i>	<i>SEM</i>	<i>t</i>	<i>p</i>
Non-ELL	20	3.70	6.56	3.43	-.53	.61
ELL	4	5.50	3.79			

Research Question Two (e). Does text-to-speech adaptive educational technology improve low literate incarcerated adults' reading competency scores differently by pre-test score?

H₀: No difference exists in the increase in CASAS literacy scores between low scoring CASAS pretest and CASAS high scoring pretest within the range of 220-238.

Half of the students ($n = 12$) participating in the study scored 220 through 227 on the CASAS literacy pretest and were grouped as low scoring. The other half of the students ($n = 12$) participating in the study scored 228 through 238 on the CASAS literacy pretest and were grouped as high scoring. An independent samples t -test was run to determine if there was a difference in test gains based on low scoring CASAS pretest (0 = low scoring) and high scoring CASAS pretest (1 = high scoring).

Levene's test for equality of variances was not statistically significant indicated equal variances can be assumed. The result of the independent samples t -test was not statistically significant $t(22) = 1.13, p = .27$. Table 4.7 reports the results of the independent samples t -test and the means and standard deviations for the two groups. The difference is not statistically significant so the *null hypothesis* was accepted.

Table 4.7

Independent Samples t-test by Low/High Score Pretest, N = 24

Incarcerated Adult Literacy Students						
Pretest	n	M	SD	SEM	t	p
Low (220-227)	12	5.42	7.29	2.50	1.13	.27
High (228-238)	12	2.58	4.66			

Research Question Three. How do low literate incarcerated adults and teacher/adult mentors explain their level of satisfaction (like or dislike) with the adaptive educational technology? Open-ended questioning provides evidence to making sense of behavior. These questions have long laid claim to being foundational, to being capable of allowing description of social and educational life as respondents perceive it (Smith & Heshusius, 1986). Researchers collect data through observation and interview. These

data are collected and analyzed in an attempt to make sense of the world and solve problems. Answers to open-ended questions add another voice in the conversation – one that stands alongside the quantitative data. Evidence related to Question Three becomes the other voice at the table.

When the study was started, 28 women at the women's correctional facility agreed to participate in the five-month project. Of these 28 women, 14 completed the study by working at least part of the time with the treatment and completing a CASAS pretest and posttest. The other 14 women dropped out of the study for the following reasons: 44% ($n = 6$) were transferred, released, or had a medical waiver from attending class; 21% ($n = 3$) completed their GED programs and did not take a CASAS posttest; 21% ($n = 3$) changed their course of study to pursue a high school diploma and no longer had access to the technology; 7% ($n = 1$) decided to work on mathematics only; and 7% ($n = 1$) did not like the Kurzweil 3000 and stopped using it.

In the men's correctional facility, 16 men originally elected to be a part of the study. Of these 16 men, 10 completed the study by working at least part time with the treatment and completing the pretest and posttest. The other 6 men dropped out of the study for the following reasons: 67% (4) left the facility or were in lock-down; 16.5% ($n = 1$) graduated with a GED and did not complete a CASAS posttest; and 16.5% ($n = 1$) did not like the treatment and stopped using it.

Data from the remaining males in the study ($n=10$) were collected using face-to-face individual interviews. All interviewed males gave multiple responses to each question. Face-to-face administration of the questionnaire was not possible with the female participants because of time constraints with the population and work schedules;

thus, data from nine of the 14 remaining females in the study were collected using a paper-pencil, mailed-in questionnaire. Sixty-seven percent of the females gave single answer responses. The IRB-approved questions were identical at both incarceration sites segregated by gender. The following questions were posed to the women (n = 9) and the men (n = 10) at the two sites.

Research Question 3 (a). How easy or hard was it for you to learn to use the computer program?

Of the male and female respondents (n = 19), 1/3 felt Kurzweil 3000 text-to-speech software was easy to learn. An almost equal percent (1/3) felt that it took too much time to learn how to use the computer software. The other 1/3 did not have a response to the question.

Research Question 3 (b). Did you like or dislike the screen-reader for studying the provided curriculum?

Students who liked the text-to-speech (screen-reader) technology cited the following reasons: ability to read and reread passages, ease at accessing definitions, and listening increased the ability to comprehend and aided in fluency. Students who disliked the technology cited the following reasons: not liking to read, not liking new things, and the perception that the technology approach was slow and boring. One-third of the students liked the software, and they offered many positive comments.

Research Question 3 (c). Which did you prefer: studying on the computer or listening with the MP3 player?

The incarcerated sample population did not have access to MP3 players so this question was not asked.

Research Question 3 (d). What would you suggest that would have helped you get better use of the computer in your studies?

The software was not interactive, so students had to write answers on their own paper and correct their responses using the answer keys located in the back of their paper workbooks. Forty-one percent of the students felt improvement in this function would have been a benefit. Some students forgot to accurately record their logged-in time and 20% of the respondents felt that a computer feature that tracked time would have been an improvement. Another 20% commented on the need for more computers so that the time spent waiting to access the computer program could have been shortened. Eleven percent would have liked more variety in the scanned materials made available to them (Table 4.9).

Table 4.8

Categorical Data, N = 19

Question	Response Categories	Female	Male	Total
How easy or hard was it for you to learn to use the computer program?	Easy - I am computer literate	22%	10%	32%
	Hard - It takes too much time to learn	33%	0%	33%
Did you like or dislike the screen-reader for studying the provided curriculum?	Like - I can go back and reread	0%	60%	60%
	Like - I can get definitions	11%	50%	61%
	Like - I can understand and go faster	11%	30%	41%
	Dislike - I do not like to read	0%	20%	20%
	Dislike - I do not like new things	11%	20%	31%
	Dislike - It is too slow and boring	11%	20%	31%
What would you suggest that would have helped you get better use of the computer in your studies?	We need more computers	0%	20%	20%
	The computers need to keep track of time	0%	20%	20%
	The computers need to score answers automatically	11%	30%	41%
	The materials need to be more interesting	11%	0%	11%

A study by Elkind, Cohen, & Murray (1993) identified and categorized five factors important for successful use of technology in enhancement of reading. Using this categorical system, this study provides evidence to support some of these predetermined categories in the following ways:

1. There must be strong personal motivation to improve reading and thereby job or academic performance. Participants expressed positive responses to the technology. Students appreciated the ability to read and reread passages and get definitions, by way of the glosses, in a timely way, and they felt that their ability to understand and read fluently improved using the software. The

access to computers was a limiting factor for some students and students agreed that it takes a commitment of time and effort to use text-to-speech software effectively.

2. Reading must be a substantial part of the day for gains in reading to occur. Students in this study were mandated to spend two hours per day in the classroom. This may not be a substantial part of the day; however, students might be reading outside the classroom environment, too.
3. Scanning simple, well-printed text was slow and sometimes inaccurate. The workbooks were sent to another campus site for scanning. The workbooks had to be unbound, scanned, edited, and returned by way of mail. The reading was done left-to-right so tables, graphs, cartoons, etc., might have been read in an incorrect order, making the passages nonsensical.
4. If the school situation is too demanding and does not allow adequate time to use technology, it will not be successful. Classroom instruction time and amount of computer time is limited at these two incarceration sites.
5. The prison environment must be adaptable to the needs of the technology. All repairs to the hardware and all software installations were performed by the technology specialists from the Midwest Central Area Community College and were not housed at incarcerated locations. Bandwidth at the sites was inadequate and that created gaps in computer usage. Text materials could be scanned in advance providing there was a one-to-one correspondence of purchased books and students using the software. Also, there must be space for the equipment. The conditions were very crowded at the facility for men.

Teachers' Perspectives

The teachers (n = 3) and mentors (n = 3) at both prison sites were individually interviewed in a face-to-face setting at the end of the study. They commented that students who really liked Kurzweil needed no prompting to use it. The teachers and mentors did not, for the most part, either encourage or discourage students from using the technology. However, they noted that some students commented that having materials read to them, even by a computer, was “not cool.” Also, the teachers and mentors believed that a major issue was computer malfunction. At the men’s site, the computers were “down” for two weeks in the middle of the study. At another point in time at the same facility, the entire site was in lock-down for another two weeks, so students could not leave their cells and come to class. At the women’s facility, the pre-GED materials were not scanned before the study began, so the program was unable to gain traction for a month. Two of the three teachers commented that the materials were not very engaging and were not interactive for students. The three mentors (one at the women’s site and two at the men’s site) felt that the technology was geared for very low level readers who just enjoyed working on a computer.

Summary

This chapter described the analysis of data used in the study, using a convenience sample of incarcerated adult students at two Midwestern prison sites segregated by gender. The students were given a CASAS literacy pretest (Form A) upon entering the program of study at their prison site. The students were given a CASAS posttest (Form B) in the spring of 2011 after completing a range of minutes using Kurzweil text-to-speech computer software that read them the preapproved adult curriculum for use in

adult education classes. The tabulated results were stored in a Microsoft Excel spreadsheet and a Microsoft Access database. The results were analyzed using independent samples *t*-tests.

The use of text-to-speech adaptive educational technology was found to improve low literate incarcerated adults' reading competency scores. None of the remaining variables (age, gender, minority status, ELL status, level of competency on the CASAS literacy pretest, or time committed to the innovation) provided statistically significant results. Of the nineteen participants providing responses to personal engagement with the software, 162% of the responses were positive and 82% were negative.

Chapter 5 will provide a summary, discussion, conclusions, and recommendations.

Chapter 5

Summary, Discussion, Conclusions, and Recommendations

This chapter reviews the findings contextualized within the study problem and grounded in the study's three research questions. After summarizing the study, results are discussed in relation to the literature on adult education, education in prisons, the use of text-to-speech educational technology, and the relationship between education and life chances. This chapter concludes with recommendations for additional research and implications for administration of effective educational programming at prison settings.

Summary of the Study

This study assessed the effect of adaptive technology (text-to-speech computer software) on incarcerated low-literate adult populations and determined the effectiveness of text-to-speech computer software technology with incarcerated adult learners seeking to improve their literacy competencies. The pre-experimental study design measured learning gains on the CASAS reading assessment posttest when compared to the CASAS reading assessment pretest. Each individual's CASAS score at the beginning of the study (pretest) was compared with his or her score at the end of the study (posttest). Group means were also compared and analyzed. Personal participant data (age, ethnicity, and beginning scores) were collected at the onset of the study. Each participant logged personal usage time in minutes spent using the text-to-speech software.

This study is part of a larger, ongoing research project in collaboration with the University Adult Literacy Center. Sixteen students at a Midwest correctional facility for men and twenty-six students at a Midwest correctional facility for women consented to be a part of the study. All consent forms and data collection forms were gathered and put

into a locked file cabinet at University Adult Literacy Center. Prisoners with an educational component to their rehabilitation plan are required by the state to be in adult education classes two hours per day. Prison release dates, personal conduct of the inmates causing loss of classroom instruction time, delays in the scanning of print resources, computer bandwidth issues at the incarceration sites, and student motivation influenced the participation rates for this study. The sample population deteriorated in size within the five-month treatment period with 14 women and 10 men (n=10) continuing the sample population at the conclusion of the study.

The following research questions guided this study:

1. Does text-to-speech adaptive educational technology improve low literate incarcerated adults' reading competency scores?
2. Does adaptive educational technology improve low literate incarcerated adults' reading competency scores differently by: (a) age; (b) gender; (c) ethnicity; (d) ELL status; or (e) initial literacy level?
3. How do low literate incarcerated adults and teachers/adult mentors explain their level of satisfaction (like or dislike) with the adaptive educational technology?

Discussion of the Findings of the Study

This section summarizes and discusses the findings reported in the analysis in Chapter 4. Three specific findings are summarized in the order of the three research questions.

1. A univariate analysis of incarcerated adults in a prison educational setting showed statistically significant academic gains on the CASAS reading posttest after using the Kurzweil text-to-speech computer software.

2. There is no statistically significant relationship between the selected demographic variables (age, gender, ethnicity, ELL status, and initial literacy level) and any change in literacy skills as assessed on the CASAS reading assessment posttest.
3. Inmates gave the following reasons for electing to continue the use of Kurzweil 3000 in their pursuit of higher literacy skills and passing of the GED.
 - Kurzweil helps me understand.
 - Kurzweil helps me get the work done faster.
 - Kurzweil allows me to “hear” and “hear again” because I pause and review previously recorded passages.
 - Kurzweil displays a dictionary (glosses) that helps me know what words mean.

Inmates who elected to discontinue use of the computer software identified the following obstacles as reasons for dissatisfaction with the text-to-speech computer experience.

- There was not enough time to learn to use the computer program.
- I work better in books.
- The program was not interactive enough for me.
- There were not enough computers available that had the software downloaded.
- I do not like to try new stuff.

A statistically significant relationship was found between the use of the text-to-speech computer software and learning from the CASAS pretest for reading assessment to the CASAS posttest for reading assessment. The results reached significance with the

P-value of 0.0299 using a $p < 0.05$ as the cut off though the sample population ($n=24$) was small. Although there was a positive overall statistically significant finding between the use of the text-to-speech educational technology and improvements in CASAS score, there was no statistically significant finding between improvements in the CASAS score and demographic measures of age, sample group sites, English language learners, minority status students, or initial CASAS scores.

The results of this current study support those of the Iowa Longitudinal Study of Special Education Middle School Students ($n=20$), which also used the Kurzweil technology and found a significant increase in literacy with a small sample size. The Iowa Longitudinal Study realized and incorporated the need for strong personal motivation, reading for a substantial part of the day, and a supportive environment, all characteristics identified as most important for successful use of technology in terms of enhancement of reading skills (Elkind et al., 1993).

Studies of educational technology's potential for increasing literacy are particularly important for individuals and the American society in the context of the economic challenges. The sustained rate of high school dropouts, the growing number of immigrants who are Limited English Proficient, the increase in incarcerated populations, and the low number of adults enrolled in adult education and not moving along paths to postsecondary and occupational training are likely to contribute to escalating economic problems in the United States. A growing pool of adults with low skills and language deficiencies—a population that is not college- and career-ready or able to compete in a global workforce—constitutes a national problem. Adding twenty million additional workers with post-secondary education, and there is a demand for educated workers in

the United States, could potentially boost the gross domestic product by \$500 billion (Autor et al., 2008). Adding 20 million postsecondary-educated workers over the course of the next 15 years is not impossible (Carnevale & Rose, 2011), but it does require educators to explore new ways of educating adults.

These economic circumstances especially challenge prison inmates' ability to participate effectively in the job market. Current research indicates that prison education programs should be rehabilitative and should enable inmates to secure employment upon release, thereby reducing poverty and giving them an opportunity to become contributing members of society (Conlon et al., 2008). Prison inmates' literacy level is lower than that of the general population, so inmates stand to improve their life chances significantly upon their release from prison with increased literacy. The effects of educational technology on literacy are especially important for this population.

The mission of correctional education is threefold. First, as inmates gain knowledge and skills, they should be qualified for employment upon their release into the community; second, education in prison should serve as a mechanism that enables inmates to learn to think more responsibly; and last, this combination should make it less likely they will return to prison (Messemer & Valentine, 2004). Years of research examining the effectiveness of educational programs during incarceration have made it apparent that adult educational programs are effective at reducing recidivism (Bouffard et al., 2000; Cecil et al., 2000; Wilson et al., 2000).

It is critical to identify the best strategy to maximize any potential positive impact of prison education on recidivism and employment. The Iowa Text Reader Longitudinal Study 2006-2007, the work of a collaborative team across the state of Iowa (Hodapp et

al., 2008), hypothesized that use of Kurzweil 3000 as an accommodation would improve middle school students' access to core content through improved fluency and comprehension. The results documented that students accessed information twice as fast and performed significantly better on passage comprehension measures when accommodated with the Kurzweil 3000 text-to-speech computer software than when not accommodated. A recent research project using case study data of adult learners demonstrated that supported access to computer-based assistive technology for adult education students with learning disabilities provided an enriched and empowered learning environment through multi-sensory, intense engagement with print and opportunities to make personal connections to standard curriculum (Silver-Pacuilla, 2004).

The following conclusions arose from the findings:

1. Incarcerated low literate adult learners can experience learning gains as demonstrated on the CASAS posttest for reading by using text-to-speech computer software.
2. There is insufficient support to suggest a significant impact of selected observable demographic variables on an increase in literacy skills as assessed by the CASAS reading assessment posttest.
3. One third of the participants expressed satisfaction concerning with the text-to-speech computer software.

Directions for Further Research

This study's results point to the need for further research in several areas. First, further data, both quantitative and qualitative, are needed in order to clearly link text-to-

speech access for low literate adult learners to learning gains. Such data should encourage the development of increased and improved educational opportunities for low literate inmates. Longitudinal tracking of incarcerated adults and their ability to legally and economically survive upon release is paramount to the future of the nation. Their success will depend on educational training.

The second area with significant potential for inquiry concerns the K-12 educational experiences of minority status students that might contribute to their dropping out of school. The limited research in the area of Black student success highlights vulnerabilities beyond the challenges that all students face as they begin high school (Benner & Graham, 2009). Black students may feel culturally isolated due to negative media images, distrust of schools, and schools' low expectations of them. The Hispanic population is also vulnerable due to English language barriers, increased educational requirements such as a greater number of required credits in core content areas for graduation, gang activity, teen pregnancy and health issues (Bennet, 2007). Recognizing these vulnerabilities, the United States Departments of Justice and Education have launched the Supportive School Discipline Initiative to eliminate misguided and harmful disciplinary practices that can push students out of school and into the justice system. The initiative will support good discipline practices that foster safe and productive learning environments in every classroom (United States Department of Justice, 2011). It will do this by building consensus for action among a wide variety of stakeholders; collaborating on research and data collections; developing guidance to ensure that school discipline practices and policies comply with the nation's civil rights

laws, keep students in school, and improve the climate for learning; and promoting effective policies and practices among state judicial and education leaders.

This “systems thinking” approach, which brings community stakeholders to the table, will increase the knowledge base underlying educational practices in K-12 systems. If all high school students graduate, there will be no need for K-12 content remediation in the incarcerated adult setting; all inmates would pursue post-secondary training. Today is a new learning ecology; we need workers with skills and competencies to become earners, learners, and engaged citizens.

There is also a need for innovation in policy at a more local level. This new state vision could ultimately impact the degree to which incarcerated adults enter the prison system without adequate literacy skills to pursue a college-ready curriculum. In a newly unveiled project called “One Unshakable Vision: World-Class Education for Iowa,” the Iowa Department of Education is setting the stage for creating high expectations for all K-12 students (Glass, 2012), including the ending of social promotion at third grade. Only students who are proficient in reading will be promoted to fourth grade after a state-wide reading assessment in March of their third grade year. This point in a student’s development is a critical juncture at which children transition from “learning to read” to “reading to learn.” Social promotion—moving children along who are not ready—puts such children at a huge disadvantage for dropping out of school, a reality witnessed with the adult population in this study.

In addition to the need for further research about educational technology’s role in increasing literacy and the factors that impact minority status students’ choices to remain in school, training and support are needed for educators. Specifically, educators in the

prison setting need training and support as they initiate a blended classroom. Teachers should understand the “whys” and “whens” of technology, not just specific tools (Hertz, 2011). Also, the classroom culture must value technology usage. Simply requiring teachers to use certain applications or tools will not transform a teacher’s instruction or the learning in the classroom (Hertz, 2011). Insight into the most effective ways to help teachers implement embedded technology in a classroom could be gained through a comprehensive study. Once the most effective professional development methods are determined, such professional development could be mandatory for all educators of adult learners in ABE and ASE classrooms.

High-quality adult instruction, with an emphasis on incarcerated learners, is essential for fostering successful student outcomes and is dependent upon substantive professional development. Educators in prison environments work with limited resources and few professional development opportunities (Peterson, 2009). It is recommended that educators have at least 10 hours of planning per week with two-week periodic timeframes in which to develop meaningful lessons, participate in meaningful collaboration with colleagues, and pursue opportunities for greater assessment of student learning through work samples (Darling-Hammond, 2010). The educators in this study lacked support for intensive professional development due to constraints on their budgets as well as work time designated for professional development. The widespread adoption of text-to-speech technology may be a second-order change for educators, and the extent of professional development attached to such an innovation must be adequate to advance the changes needed. Working in a blended classroom that includes direct instruction and technology may be difficult for educators unaware or misinformed about the skills

necessary to create the change needed for implementation. Examining the infrastructure and capacity for change in the learning environment helps build a case for reform.

In essence, educators who embark upon changing their mental model of instruction can find the task perplexing and exhaustive. They may regard this paradigm shift as virtually impossible to grasp without a scaffolded and supportive role for professional growth and understanding within the androgogy needed for this subset of learners. Perhaps options for such professional development could include a collection of teacher videos and lesson plans embedding the use of text-to-speech computer software. Rigorous, just-in-time-learning, made mandatory for the professional development of teachers with adult low literate learners, could also be necessary. Future studies will also need to properly account for pre-existing teacher ability so that professional development is meaningful and deliberate for a wide variety of educator expertise. A valid and reliable system of evaluating the professional development is also needed.

The curriculum that is used in the adult learning environment needs to be analyzed to see if it meets the needs of adult learners or if it is patterned after the failed curriculum and teaching practices used when the prisoners were younger and in K-12 educational settings. Would scanned literature that is high quality and contextually dependent serve as a better vehicle for gains in vocabulary acquisition, comprehension, and fluency? What reading genre stimulates engagement in the written text for an adult learner, and will providing more time to read within an adult setting foster greater learning gains in literacy? What conditions foster a reading environment for adults? Examining these questions could yield curricula that respond to the recognition that adults prefer to learn through self-direction and connections with their own experiences

and needs (Bruner, 1961). Such curricula would be more likely to motivate adult learners since adults are motivated to learn to the extent that they perceive that the learning will help them perform tasks or solve problems related to their life situations (Tough, 1971).

Further research in the area of computer literacy of inmates would help bridge technical issues that arise when introducing embedded technology into a blended classroom. Incarcerated populations have varying degrees of literacy in computer and technology skills. While some prisoners may have very limited skills using the technology of today, others, especially younger ones, may have been surrounded by computers, digital videos, cell phones, video games, the Internet, and online tools prior to incarceration. The latter group may think and communicate in fundamentally different ways than any previous generation (Jukes et al., 2010). This diverse pool of learners will require diverse opportunities in partnering with educators in prison educational systems. The use of text-to-speech computer software provides the opportunity for tech savvy students to continue learning in a digital world and the less experienced students to advance their skills to be better able to meet technology challenges in the world today and at the same time, increase their literacy skills. Research in this area should address at least two major questions: Would access to more hardware and a more extensive array of software options increase learning in the prison setting? Would an increase in technology application instruction help alleviate some of the initial frustration some of the inmates felt at the beginning of the treatment?

Further research should also investigate the use of computer speech synthesizers (text-to-speech) for reading instruction, remediation, or compensation with adults, since much of the existing research has focused on children. Adult participants who gained the

most from using the technology initially had poor unaided reading rates, comprehension, and endurance (Elkind, 1996). Would the text-to-speech computer software application provide learning gains for Adult Basic Education (ABE) students scoring below 220 on the CASAS reading assessment? Would a system of multiple assessments over time provide evidence to support the claim that text-to-speech adaptation in the prison environment is a positive and needed addition to the structure of the current educational environment? Would the use of a control group sample population in a research study provide further evidence to support the claim that text-to-speech computer software is a valuable learning resource for adult students with low literacy skills? Would low-level literate adults coming into a “walk-in” campus setting benefit from using the text-to-speech computer software technology?

Operationalizing the theoretical frame of Dual-Coding Theory required a slight shift from the theory’s original interpretation. Would Dual-Coding Theory, in the original interpretation, become a conceptual model enhancing increased progress in reading for adults with low levels of literacy? In Paivio’s (1986) presentation of DCT, “dual” requires both verbal and nonverbal modes. Text-to-speech software instead uses two different forms of verbal communication—written and spoken. Thus, DCT theory was slightly modified in this study. Possibly, the use of more graphic and photographic representations in the text could increase the learning outcomes for the low-literate adult learner.

Additional research on ways in which instructors can help students raise their scores on the CASAS would also be useful in improving prison education. As discussed in Chapter 2, the CASAS is the assessment tool used in adult education classes to

measure learning gains of students. In cooperation with the CASAS National Consortium Policy Council, CASAS conducted a study to provide guidance to program and instructional staff regarding student readiness to take the GED Tests. The study found a clear positive relationship between CASAS reading scores and GED reading scores (Comprehensive Adult Student Assessment System, 2008), and a clear positive relationship between CASAS reading scores and overall GED results averaged across all five tested content areas of reading, writing, science, social studies, and mathematics. As learners move from CASAS level C to D to E, the data show a significant increase in GED pass rates at each level. CASAS standard procedural assessment policies state the amount of instructional time between the administration of the pretest and posttest forms should include approximately 70-100 hours of instruction (Comprehensive Adult Student Assessment System, 2010). Would a replicated study with an increase in quality hours of instruction and embedded access to text-to-speech educational technology create a statistically significant learning gain for the selected demographic variables? Would a study using an incarcerated control group with a matched population produce similar positive results?

This study's finding of a positive relationship between characteristics of the adult learner and the ability of this population to persist in attaining the goals that they believe are necessary suggests that further research into this relationship is needed. What characteristics of persistence must a low-literate, incarcerated adult learner possess in order to build the self-efficacy and the motivation necessary to successfully complete a prison educational program? Does the use of text-to-speech technology lay a foundation for future learning? Would students begin to embrace the "growth mindset," as opposed

to the mindset of “set intelligence,” by using the text-to-speech technology? What student work-samples could be analyzed, and how might the data be used to ensure that students are learning? These could be considered unintended outcomes. However, as literacy capacity builds for inmates, questions for consideration in future research are abundant.

This study encourages the formation of many new potential inquiries. Reading provides direct access to knowledge and national data indicate that large numbers of adults in the United States do not have the literacy skills to effectively participate in today’s workplace and society (Kirsch et al., 2007). Studies show that an increase in English reading time has a positive impact on English literacy (Hafiz & Tudor, 1989). Adult education research does indicate that adults can make progress in each component of reading: fluency, vocabulary, and comprehension (Kruidenier et al., 2010). Fluency can be improved (Mostow et al., 2003), increased vocabulary acquisition is a by-product of reading (Huckin & Coady, 1999), and reading comprehension increases with explicit instruction (Duffy, 2003). However, most of the findings are emerging findings because they are based on a relatively small body of experimental research (Kruidenier et al., 2010).

Implications and Conclusions

Learning is complicated and unpredictable. The prison educational system must support teacher and student learning in a systemic and forward-thinking way. Students learn in non-standardized ways at times. It is necessary to adapt to student needs, meaning that standardized education is outdated (Darling-Hammond, 2010). Text-to-speech adaptive technology is a non-standardized approach to embed technology into a

blended classroom. The educational system will be strengthened if the instructional approach which focused on “covering” or “going through” a workbook, independent of sense-making and conversation, becomes a practice of the past. With re-teaching and formative assessments embedded in the instruction, students’ learning will increase (Iowa Department of Education, 2011b).

About 85% of GED graduates who enroll in postsecondary education must take at least one remedial course, which lengthens the time it takes to earn a credential or degree and increases instructional costs (Duke & Ganzglass, 2007). It is necessary to begin with the end in mind. Would it help advance student learning if individual learning plans were created for each individual student with the express purpose of reducing remediation in more advanced studies? Could a feedback loop with embedded formative assessment including expanded and courageous conversations, and a nuanced view become reality for the incarcerated population? Would a wider range of student entry points create a more robust and authentic environment for these fragile learners? Will CASAS literacy scores continue to advance, remain the same, or decrease over time as students continue to use text-to-speech computer software?

In a final look at the study’s central questions about programmatic response to adult incarcerated populations with low literacy skills, the evidence supports continued research and study of the use of text-to-speech computer software to increase learning gains in literacy. While sound and well-intentioned, this research will require a great deal of commitment, collaboration, and consideration from multiple stakeholders and policymakers; it will not occur without significant time, talent and resources. However, in the end, it may not be overstating the case to say that our economic future as a nation

may depend on restructuring the educational landscape to include the students that leave the educational system before completion. There is evidence and hope for incarcerated adult learners with low literacy skills.

Text-to-speech technology does not damage the sample population or the observable demographic populations in the study. That is a positive outcome of the study. The next question becomes: How does the educational community take a good practice and move it forward? What are the policy issues that must be transformed to create a reality for capacity and growth? How is fidelity to the system nurtured, what supports are needed to build a deep understanding of the educational variables, and how does the system support students and teachers through the changes? In what ways can traction for a new approach be accelerated so a system can move in positive directions? What characteristics must the leadership possess in order for change to occur?

The potential for text-to-speech technology to improve the literacy, and thereby the life chances, of prison inmates is evident. While this improved outlook does not happen overnight, the groundwork laid by text-to-speech technology is deeply important for students' development. In tough economic times, it is understood that cost-saving measures may be necessary. However, as legislators battle to control costs and balance budgets, it is imperative that they remember that a strong education system produces a strong community and economy. A well-educated nation reaps extraordinary economic, civic, and social benefits. An investment in prison education will yield a high return that will continue to pay dividends for decades.

The Moso bamboo plant grows in China and the Far East. After the Moso is planted, growth occurs slowly for up to five years – even under ideal conditions! Then, as

if by magic, it suddenly begins growing at the rate of nearly two and a half feet per day, reaching a full height of 75 feet within six weeks. But it is not magic. The Moso's rapid growth is due to the extensive root system it develops during those first five years...five years of getting ready (Weldon, 2008).

Low-literate adult learners are like the Moso bamboo. Text-to-speech software may develop a root system (foundational reading skills) over time. When the skills are in place, the student will flourish rapidly, as if by magic!

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Appendix A

Definitions of Key Terms and Acronyms

Adult - Students in this study must be 18 years of age or older.

Assistive technology - A category of technology used by persons to provide access and help in learning tasks.

Comprehensive Adult Student Assessment Systems (CASAS) - The most widely used system for assessing adult basic reading skills within a functional context.

CASAS is the only adult assessment system of its kind to be approved and validated by the United States Department of Education and the United States Department of Labor to assess both native and non-native speakers of English.

Des Moines Area Community College Adult Education programs use this tool to evaluate the effectiveness of adult education and literacy programs. Results are reported on common numerical scale. This scale has been validated on more than three million adult and youth learners (CASAS, 2010).

Comprehension - Level of student understanding of the written text.

Fluency - In fluent reading, word recognition is sufficiently automatic and accurate that the reader's attention is focused on the meaning of the text. Fluency is the ability to read a text accurately and quickly. When fluent readers read silently, they recognize words automatically. They group words quickly in ways that help them gain meaning from what they read.

Gloss - A brief notation of the meaning of a word or wording in a text. It may be in the language of the text or in the reader's language if it is different. A collection of glosses is a glossary.

Implementation - Application of the innovation with strict compliance to the intervention schedule, i.e., fidelity (quality of application) and integrity (completely and as scheduled).

Kurzweil 3000 - A text-to-speech software that provides multi-sensory access to text and curriculum and is used by the Midwest Central Area Community College Adult Education Program. This multi-sensory access allows users to engage in reading-level appropriate materials. Research has shown Kurzweil to be highly effective in addressing the development of three critical reading skills: fluency, vocabulary, and comprehension. The software also includes ten dictionaries, including translations in four languages; encyclopedias; and Wikipedia.

Literacy - A position in which an educated person has access to a multilayered history of experiences with language and content across many contexts.

Literacy competencies - CASAS identifies nine broad competencies that are relevant across all instructional levels: basic communication, community resources, consumer economics, health, employment, government and law, math, learning and thinking skills, and independent living. CASAS is a standards-based system that relates to national and state-level standards. CASAS results provide feedback to learners and instructors to target further instruction.

Outcome measures - Technically adequate and sensitive measures of the effects of the technology on the targeted skill area. For example, if the target were the improvement of literacy competencies, an appropriate measure would include the pre- and post-CASAS scores shown to be reliable and valid.

Prosody – Compilation of spoken language features that include stress or emphasis, pitch variations, intonation, reading rate, and pausing.

Text-to-speech software - A category of software using scanned, digitized text that can convert any written text into spoken word. Leading examples include Kurzweil 3000, Wynn Scan, Read and Write Gold, and Read Software.

Vocabulary - The understanding of a small group of unfamiliar and select words as they name the things we know about.

Appendix B

Informed Consent Form

We invite you to be in a research study of the new DMACC GED program. In the new DMACC GED program, a computer will read aloud to you while you read on the computer screen. We think this will help you get ready to take GED test sooner. However, it does not mean that you will pass the GED test. You can enroll in the study until January 20, 2010. The study will be completed in June 2010 or when you finish taking the GED tests.

- You can be in this research study because of your CASAS pre-test reading score. You will use headphones and a computer screen that highlights the words for you. This is different than the computer use of other people who are studying to take the GED tests who had different CASAS pre-test reading scores than you. This might cause you to feel self-conscious.
- Before the study begins and at the end, we will ask you some personal questions about your employment and income. This may cause some stress or embarrassment. You do not need to answer any questions that you feel are too personal.
- All information is confidential. Your name will not be used in this project.
- All test results will be kept in a secure database.
- You will stay in this GED class whether or not you choose to be in this study. Even if you are not in the research study, the computer will still read aloud to you because that is part of the new DMACC GED program for people who score close to you on the CASAS test.
- You are free to withdraw from the research study at any time and your information will not be used for research.
- At the end of the project we will ask your feedback about how computer did or did not help your learning.
- Results of this study will be at the Success Center by the end of the summer if you would like to see them.

For more information or if you have questions, call

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Drake University Adult Literacy & DMACC
Virtual Literacy to Succeed Project

I understand and agree to the terms of this Agreement.

Student

Date

Interviewer

Date

Appendix C

Virtual Literacy to Succeed Intake Interview Form *

DEMOGRAPHIC DATA

1. Interview date _____
2. ID number _____
3. Name _____
4. Address _____
5. City State Zip _____
6. Birthdate (mm/dd/yyyy) _____
7. Gender _____
8. Race/ethnicity _____
9. Education (highest grade completed) _____
10. Limited English Proficiency (yes/no) _____
11. Current employment status (full-time, part-time, temporary) _____
12. Current/most recent hourly wage _____
13. Current/most recent hours worked per week _____
14. Health insurance - single? family? (yes, no, unknown) _____
15. Homeless (yes, no, unknown) _____
16. Formerly incarcerated (yes, no, unknown) _____
17. Computer skills (none, basic, intermediate, proficient) _____

Questions:

1. How do you learn best? Listening, reading, watching or seeing, doing
2. What struggles are you having in studying for the GED tests?

AT COMPLETION OF STUDY

1. Entered employment (date) _____
2. Exit employment (date) _____
3. Employment in target industry sector (list industry) _____
4. Hourly wage at placement _____
5. Weekly hours at placement _____
6. Individual health insurance offered (yes, no, unknown) _____
7. Individual health insurance accepted (yes, no, unknown) _____
8. Family health insurance offered (yes, no, unknown) _____
9. Family health insurance accepted (yes, no, unknown) _____
(if study is continued)
10. Job retention at 6 months (yes, no, unknown) _____
11. Job retention at 12 months (yes, no, unknown) _____

Questions:

1. How easy or hard was it for you to learn how to use the computer program?
2. Did you like or dislike using the screen-reader for studying GED materials?
3. Which did you prefer: studying on the computer or listening with the MP3 player?

4. What could you suggest that would have helped you get better use of the computer in your studies?

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