Reciprocal Teaching as a Reading-Comprehension Strategy Among First-Year Industrial Technology Teacher-Education Majors At the University of Technology, Jamaica

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ABSTRACT

There is a perception among faculty at the University of Technology, Jamaica (UTech) that Industrial Technology students in the Faculty of Education and Liberal Studies (FELS-IT) have difficulty learning non-technical content due to their weak reading-comprehension skills. Reciprocal Teaching strategies have been shown to improve students' reading-comprehension and learning, especially across the United States and Europe (Palincsar and Brown, 1984; Rosenshine and Meister, 1993, 1994). By means of a researcher-developed Cloze-type assessment instrument, this study investigated reciprocal teaching (Palincsar and Brown, 1984) as a possible means of addressing this perceived problem in Jamaica.

A total of 133 participants were involved in the study. Specifically, the study explored empirically the existence of a reading-comprehension problem among the first-year Industrial Technology teacher-education majors at UTech, and the self-perceptions of the participants with respect to their reading-comprehension skills. The study primarily investigated the effect of the reciprocal teaching strategy on improving reading-comprehension scores at the tertiary level, and its perceived efficacy by the participants. An evaluation of the evidence-based findings was used to determine whether to recommend implementing reciprocal teaching into the UTech teaching methodologies, with the overarching aim of improving student achievement.

The findings of this quasi-experimental study suggest that the FELS-IT first-year teacher-education majors are not significantly different from other first-year students enrolled at UTech. Also, the reciprocal teaching intervention significantly improved the group-mean and individual post-test scores of the Treatment group over those of the Control group, and was favorably perceived. The investigation recommends that reciprocal teaching should be implemented across all faculties at UTech, preferably among the first-year students.

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E.R.L.

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CHAPTER I
INTRODUCTION

Upon entering the University of Technology, Jamaica (UTech) to pursue a Bachelor of Education (B.Ed.) degree in Industrial Technology (IT), students are greeted with the well-used cliché, "You are here to *read* for a degree." The institutional administrators and lecturers generally assume that these students *can* read, implying "decode" or possessing word identification skills (Mayer, 2008), which is accurate. However, no formal assessment is required or made as to the efficiency of their reading-comprehension skills by UTech. Some of these students, who just a few months earlier were the pride of their secondary school teachers, confident and successful, soon become frustrated, underachieving college students. They are suddenly being asked to undertake a greater responsibility for their own learning in a new, sometimes academically hostile learning environment, at a significantly faster pace and at an advanced level. Some of these students with weak reading-comprehension skills are ill prepared, and therefore unable to rise to the unique challenges of a tertiary education (Barrett and Onyefulu, 2007; Choo, Eng, and Ahmad, 2011).

Background

Over the past several years, lecturers in the Faculty of Education and Liberal Studies (FELS), the teacher-training faculty at UTech, have observed that a large proportion of the pre-service Industrial Technology teacher-education major population struggle academically, and are underperforming, relative to other comparable non-Industrial Technology teacher-education majors. Many of these Industrial Technology students do well enough within their technical specialist subject areas, but underachieve in other essential 'professional' related subjects. When quizzed, these students indicated a strong preference for courses with practical components over reading-intensive courses, which suggests a possible reading-comprehension issue. Lecturers who teach pedagogical and other non-specialist courses have long questioned the poor text-comprehension skills of the Industrial Technology students in particular, based solely on anecdotal evidence. However, no formal attempt has been made to investigate this *apparent* problem with a view of verifying its existence, and proposing a feasible solution should a problem, in fact, exist.

Palincsar and Brown (1984) designed a teaching/learning approach that they claimed has, by and large, aided the improved performance of reading-comprehension skills across a wide and varied range of learners (Rosenshine and Meister, 1993, 1994). Referred to as "reciprocal teaching" (RT), this teaching/learning strategy focused on developing four critical components of the comprehension-monitoring and comprehension-fostering proficiencies of readers, namely: (i) summarizing, (ii) questioning, (iii) clarifying, and (iv) predicting.

If the principles of reciprocal teaching postulated by Palincsar and Brown (1984) hold true, then reading-comprehension skills may be more closely associated with prior exposure to suitable comprehension-awareness and comprehension-fostering strategies, than to general intelligence, as is often implied. This would suggest that if an effective intervention could be identified and successfully implemented at UTech, then the negative impact of this perceived problem might well be diminished. Furthermore, the Industrial Technology students with weak reading-comprehension skills, and other students too, may be taught how to potentially positively impact

their reading-comprehension capacities, and be spared from further academic frustrations, failures, or embarrassing stereotyping.

Need and Significance of the Study

The Faculty of Education and Liberal Studies at UTech prepares specialist technical teacher-education majors, in particular, who are trained in one of the following three disciplines, collectively called Industrial Technology: (a) Construction Technology (CT), (b) Electrical Technology (ET), or (c) Mechanical Technology (MT). Upon graduation, these technical teacher-education majors are employed in the secondary and lower tertiary levels of the educational systems in Jamaica and throughout the English-speaking Caribbean region. Several experienced members of the faculty suspect that periodically some students enter the Industrial Technology Program with deficient reading-comprehension skills. Neither data nor documentation has been found to date that supports this allegation. This study sought, in part, to address this issue by providing objective empirical evidence, for or against, relating to the research assumption of the existence of a reading-comprehension problem. Furthermore, should an effective reading-comprehension strategy be identified and successfully implemented, it would be expected to improve the general academic performances of the impacted students with weak reading-comprehension skills, and could be extended across students of all disciplines.

For almost four decades, considerable research has been conducted on the improvement of reading-comprehension through a variety of novel teaching and learning strategies. However, most of this research was conducted with young children as study participants in North America, Europe, and Australasia. There remains a need to explore the impact of various reading-comprehension strategies on other populations. This study begins to address that need by investigating reciprocal teaching methods (Palincsar and Brown, 1984) with Jamaican and Caribbean college students as Jamaican educators seek to promote meaningful, life-long learning. Both Livingston (1997) and Rinehart and Platt (1984) conclude that metacognition, or the higher order thinking about one's own mental processes, involves active control over the cognitive processes (e.g. the planning, monitoring, and evaluating of cognitive tasks), which is engaged in by efficient, successful learners (Livingston, 1997), and is a lacking component of some inefficient readers, and that:

> Many of the difficulties of the inefficient reader may be due to deficits in metacognition, as evidenced by a lack of awareness and control of the cognitive demands of a task (Rinehart and Platt, 1984, p. 54).

Rinehart and Platt (1984) also suggest that a suitable strategy-use is critical to successful reading-comprehension. They state that "The ability to employ appropriate strategies and monitor their use is an important part of reading" (p. 55). Alternatively, Flavell (1979) concludes that students can be taught these requisite skills directly. Flavell, while specifically addressing learning in children, expresses the notion "… that increasing the quantity and quality of children's metacognitive knowledge and monitoring skills through systematic training may be feasible as well as desirable" (p. 910). Flavell further states:

> It is at least conceivable that the ideas currently brewing in this area could someday be parlayed into a method of teaching children (and adults) to make wise and thoughtful life decisions as well as to comprehend and learn better in formal education settings. (Flavell, 1979, p. 910).

Much of the formal written information that is disseminated at the tertiary level is delivered via technical and expository textbooks and lesson notes. The student is also typically expected to garner significant portions of scholarly material independently on a daily basis. Therefore, it is of critical importance that all tertiary level students in particular be able to master the skill-set of effective reading-comprehension. If these students are not adequately prepared at the secondary level to independently acquire and process this information through efficient reading-comprehension skills, their potential to optimize their tertiary academic achievements would be severely restricted. However, despite appreciating the importance of possessing strong reading-comprehension skills, UTech does not currently assess for, nor provide specific assistance to students with known or suspected *reading-comprehension explicit* problems. Therefore, this study also sought to identify tertiary-level students at risk of academic failure or underachieving, with an intention to recommend suitable remedial actions for such students, their tutors, and for the UTech administrators to have implemented in their programs.

Students entering the Industrial Technology programs come from a variety of secondary school-types (i.e. traditional, technical, comprehensive, and new secondary) from across the island, and in some instances, the wider English-speaking Caribbean. Although satisfying the general UTech matriculation requirements, there are differences between the degrees of tertiary-level preparedness provided by these schools. Mastery of the English Language and reading-comprehension are essential skills for any aspiring or practicing educator to possess. Yet several of their lecturers perceive that these requisite skills are often lacking or are under-developed, and that these students are typically ignorant with regards to possessing effective learning strategies. Indeed, Barrett and Onyefulu (2007) investigated a typical group of first-year Industrial Technology students from UTech, and concluded that they were not adequately prepared for the rigors of tertiary education. Therefore, this researcher concluded that reading-comprehension capability is one such area of concern worthy of investigation.

English Language is the only formal mode of communication used in Jamaica. This former British colony has a widely used *patois*, or local Creole dialect derived from English and various African Languages, but this is spoken informally. For the regional "English A" (i.e. English Language) Caribbean Secondary Education Certificate (CSEC) examination, the recorded pass rate (i.e. Grades I-III) is a mere 46.2% for the year 2012 (*The Gleaner*, August 11, 2012), down from a dismal 67%, which represents an all-time high over the 8-year (i.e. 2004-2011) mean-score of approximately 55% (Caribbean Examinations Council, 2011). This, in an English-speaking territory suggests the existence of a grave problem. However, as the following daily newspaper report by Dr. Ralph Thompson indicates, even among the elite Jamaican traditional high schools (e.g. Calabar High School for Boys), there have existed long-standing, major educational challenges with respect to mastery of the English language:

> For instance, Calabar High School had a total cohort of 401 *(High School Seniors)*, but allowed only 206 students to sit the English exam. Only 67 passed, a pass rate of 16.7 per cent. In the official statistics from the Ministry of Education, Calabar's pass rate is given as 33 per cent, 100 per cent better than the actual performance. *Italics supplied*. (*Jamaica Gleaner*, Nov. 14, 2004; Thompson, 2004).

This researcher conducted a pilot-study as a preliminary assessment of the reading-comprehension levels among volunteer first-year Industrial Technology teacher-education

majors enrolled in the 2010-2011 academic year. The findings indicated that a significant reading-comprehension problem did exist among the target population. As such, this study was interested in ascertaining and *evaluating* the potential impact of the reciprocal teaching/learning strategy on reading-comprehension mastery among first-year Industrial Technology pre-service teacher-education majors. The general intent of this investigation was to *utilize* the empirical data obtained to advise the administrative decision-makers whether to implement the widespread use of the methodology of reciprocal teaching as a culturally bias-free instructional strategy with the potential of positively impacting on reading-comprehension, and thereby academic performance. The key UTech stakeholders and decision-makers need research-based, scientific evidence to guide their deliberations, which prior to this study was non-existent, unknown, or extremely limited. Moreover, these teacher-education majors might be more inclined to employ reciprocal teaching strategies in their teaching once they have experienced the successes of using the strategy, and thereby be enabled to augment the reading-comprehension capacities of their own students in the future.

There is a critical need to develop, evaluate, and implement research-based teaching strategies that are based on established theories of learning appropriate for the field of Industrial Technology, and in particular, for the Jamaican and Caribbean cultural context. The seminal work of Palincsar and Brown (1984) in conjunction with two meta-evaluations conducted by Rosenshine and Meister (1993, 1994) reported that the reciprocal teaching methodology was an effective teaching/learning strategy for improving reading-comprehension skills in an extremely wide cross-section of learners, across various age groups and ability levels, and even across national borders. Although research on this topic appears to be quite limited in Jamaica and the Caribbean region, it was expected that the general findings would be similar to those found by researchers in the USA, Europe, and elsewhere. Furthermore, it was hoped that this study could effectively contribute to the existing body of knowledge regarding positively impacting reading-comprehension. This information could also impact on the teacher-training program, infusing its curriculum, faculty teaching-methodologies, and graduates.

Statement of the Research Problem

The observation of four educational issues served to motivate the researcher to conduct this study:

1. In Jamaica and the Caribbean region, the educational sub-discipline of Industrial Technology has not produced volumes of original educational research-based theories and findings to guide and direct this specialist field of instruction, opting instead to accept the recommendations coming from mainstream and other international educational research as its guide.

2. UTech neither requires nor offers any formal assessment of students' reading-comprehension levels. Therefore there is no way of scientifically and reliably determining whether a reading-comprehension problem truly exists among the Industrial Technology students or not.

3. Palincsar and Brown (1984), the developers of the teaching strategy, Reciprocal Teaching, claim that this instructional method improves reading-comprehension across all student-levels, and in a wide variety of learning contexts. However, the legitimacy of these claims

has not been verified in the Jamaican context.

4. Program Administrators need rational data to assist them in the decision making process of whether to implement reciprocal teaching as a tool to aid in enhancing the reading-comprehension of their students, and whether this strategy should be extended to incorporate other students and programs.

There was general consensus among the lecturers in FELS that the generally weak academic performances of some Industrial Technology teacher-education majors, especially with regard to theoretical content, may be attributed in part to poor reading-comprehension skills. Some FELS lecturers also believed that this perceived inadequacy was having a negative impact on the success rate of the Industrial Technology students in particular, and the teacher-training programs within the Faculty of Education and Liberal Studies in general, and hence posed a serious concern to the faculty, and by extension, the institution.

Tertiary level students rely heavily on text-based materials for a significant quantity of information essential to their academic success. In order to acquire and assimilate this information, the learner must possess and implement appropriate reading-comprehension skills, as anticipated by the researcher. Students without these requisite skills are at a high risk of personal underachievement and or academic failure.

UTech neither requires nor offers any formal assessment of students' reading-comprehension levels *per se*. (There is a mandatory English Language Proficiency Test (ELPT) administered to all first-year (i.e. freshmen) students. However, this is really a 'Writing' assessment (Clover-Jones, personal communication)). Therefore, there was no way of determining objectively whether or not a reading-comprehension problem truly existed among any of the Industrial Technology teacher-education majors.

Therefore, the problem addressed by this study was threefold, to:

i) formally investigate the extent to which a reading-comprehension problem exists among the Industrial Technology teacher-education majors at UTech;
ii) determine the self-perceptions that the Industrial Technology students have regarding their reading-comprehension skills, and the impact of the reciprocal teaching strategy on these self-perceptions; and
iii) evaluate whether or not the use of the revised reciprocal teaching instructional strategy (Palincsar and Brown, 1984) can effectively impact in a positive manner the reading-comprehension skills of Industrial Technology teacher-education majors situated in the Jamaican, tertiary-level context, as measured by a researcher-developed, cloze-type instrument test scores.

Armed with scientifically collected data, the UTech administrators can utilize the findings of this study to determine whether or not the reciprocal teaching strategy should be employed within the program, and to make recommendations as to the extent of its application across other program options.

Purposes of the Study

The primary function of an educational study is to guide policymakers and other stakeholders into making informed, research-based decisions; in this case for example, guidance with respect to the implementation of an effective adult reading-comprehension teaching-learning strategy to improve an educational program (Best and Khan (2006), and Fitzpatrick, Sanders and Worthen (2004). For that reason, I proposed to investigate by means of objective, research-based quantitative and descriptive evidence, the extent to which reciprocal teaching as postulated by Palincsar and Brown (1984) was appropriate and effective with first-year Industrial Technology teacher-education majors at UTech in Jamaica. In effect, this study investigated the claim made by proponents of reciprocal teaching that these strategies are adaptable to, and effective with all local classroom situations, for which there is a paucity of Jamaican data available.

Accordingly, this study sought to explore, collect, analyze, and evaluate evidence pertaining to the reading-comprehension competence of the first-year Industrial Technology pre-service teacher-education majors, with the view of making recommendations for improving the effectiveness of the college level Industrial Technology program at UTech. Based on the work of Palincsar and Brown (1984), it was hypothesized that participants exposed to the reciprocal teaching methodologies would score higher on a researcher-developed cloze-type reading-comprehension test than participants who were not exposed to this methodology. The study also sought to survey the students' opinions regarding their acceptance of the reciprocal teaching methodology.

Also, there is a need to both assess existing teaching strategies, and to develop alternate methods that are both effective and based on established theories of learning, especially within the field of Industrial Technology, and in particular, for the Jamaican context. To this end, the purposes of this study were to a) provide data that would determine or discredit the existence of a genuine reading-comprehension problem among the Industrial Technology students at UTech, b) authenticate the effectiveness of the Reciprocal Teaching approach in impacting the reading-comprehension skills, particularly for Jamaican and other Caribbean students enrolled in the Industrial Technology Program at UTech, and equally importantly, c) aid in making the critical decision in answer to the all-important question "Should the UTech Program Administrators incorporate reciprocal teaching strategies into the general educational programs for all students?"

In addition, this study sought to add to the wealth of existing knowledge by contributing its findings of the observations of an instructional strategy evaluation using local students, and conducted in a regional institution. It is believed that any such findings obtained could whet the appetite, and impact significantly on the perspectives of regional educators, causing a new research culture and increased level of introspection, a regional renaissance if you will. It is hoped that accurate data would be generated and analyzed, which may be utilized to aid the decision-making process in identifying an effective measure of improving the reading-comprehension abilities of the subjects.

The results of the investigation will be made available to the lecturers within the Faculty of Education and Liberal Studies, and, hopefully, will prove to be useful in enhancing and refining the effectiveness of the Industrial Technology Program at UTech in particular, while positively impacting on the wider Jamaican educational system in general. Any findings obtained from this

study could also be used to positively impact the curriculum, teaching strategies, student efficiency and achievement, and also to implement programs to identify, support and retain potential at-risk students at UTech.

Research Questions

The following research questions guided this study:

1. Does the reciprocal teaching method improve reading-comprehension among first-year Industrial Technology teacher-education majors at UTech?

2. What reading-comprehension levels are characteristic of first-year Industrial Technology teacher-education majors at UTech?

3. What are UTech Industrial Technology teacher-education majors' perceptions of the strengths, weaknesses, and effectiveness of the Questioning and Summarizing reciprocal teaching intervention sub-strategies?

Research questions two and three were aimed at obtaining a profile of the typical students who participated in the study.

Limitation of the Study

The following limitation applied to this investigation:

1. Any inference(s) resulting from this study should be cautiously restricted in its application to other students because the researcher was unable to employ a truly experimental research design.

Assumptions of the Study

The following assumptions applied to this study:

1. Reading-comprehension is a phenomenon that can be demonstrated, taught, and reliably measured.

2. The sample population investigated possessed adequate decoding skills, but, based on observation, do have reading-comprehension challenges which need to be addressed.

3. In accordance with the literature associated with the cloze reading-comprehension test utilized in this study, the instrument is a valid and reliable measure of young-adults' reading-comprehension at the college level, and accurately indicated the reading-comprehension abilities of the first-year students at UTech.

4. The participants in the study answered the self-report survey questionnaires and focus group interview questions honestly, completely, and accurately.

5. The participants in the study performed to the best of their abilities on the *Cloze Reading-Comprehension* pre- and post-tests and assessment instruments.

6. No confounding variables were introduced into the study by delivering the intervention to the Treatment group, and there were no research-related interactions or interference between members of the Treatment and Control groups during the course of the investigation.

7. The descriptive information on the impact of reciprocal teaching resulting from this study, if favorable, will be utilized to influence the UTech administration to implement a reading-comprehension intervention for any needy students.

8. If found to be effective, reciprocal teaching can be readily implemented at UTech without too much expensive and time-consuming specialized training.

9. If recommended for adoption, the reciprocal teaching methodology will be accepted for implementation by a significant portion of the UTech teaching staff.

10. The sample population investigated is representative of a typical intake of freshman teacher-education majors into the Industrial Technology program at UTech.

11. Implementation of the reciprocal teaching strategy was conducted without any known biases.

Definition of Terms

Comprehension: A combined property of the text and a specific user segment, and indicates whether this target audience actually understands the material's meaning. (Nielsen, 2011).

Comprehension-fostering: An activity that enhances comprehension (Palincsar and Brown, 1984, p. 121).

Comprehension-monitoring: An opportunity for the student to check whether it (*i.e. comprehension, italics supplied*) is occurring or not (Palincsar and Brown, 1984, p. 121).

Construction Technology: The Industrial Technology pre-service program that specializes in Building Construction technologies.

Electrical Technology: The Industrial Technology pre-service program that specializes in Electrical Principles, Electrical Installation, and Electronics technologies.

First-year student: Equivalent to a "freshman" in the USA educational system.

Industrial Technology: A collective term for the three engineering-related pre-service program specializations of the Construction-, Electrical-, and Mechanical Technologies.

Lecturer: A teaching faculty member, known as a "Professor" in the USA educational system.

Mechanical Technology: The Industrial Technology pre-service program that specializes in Mechanical technologies.

Reciprocal Teaching: An instructional procedure designed to teach students cognitive strategies that hopefully lead to improved reading-comprehension (Rosenshine and Meister, 1994, p. 479).

Semester 1: Equivalent to the 'Fall' semester in the USA educational system.

Semester 2: Equivalent to the 'Spring' semester in the USA educational system.

Technical Education: A pre-service teacher preparation program specifically for the professional Business Studies, Family and Consumer Studies, and the Industrial Engineering-related technologies at the secondary and lower tertiary levels of the Jamaican educational system.

The Educational Setting of the Study

Jamaica is an English-speaking island nation located approximately 835 Km (520 miles) south south-east of Miami, USA. The island is approximately 240 Km (150 miles) long and 85 Km (53 miles) wide, with a total area of 10,991 sq. Km (4,244 sq. miles), just slightly smaller than the state of Connecticut in the USA. With a population in the region of 2.87 million people (July 2011 estimate), this former British colony gained its political independence in August, 1962, and has a per capita Gross Domestic Product (nominal) of J$576,834 (~US$4,926) for the financial year 2013-2014 (see International Monetary Fund 2014 data). However, the public debt currently stands at 132% of GDP (down from 146% in 2012), unemployment stands at 15.3%, and approximately 16.5% of the population lives below the poverty line. These harsh and burdensome economic conditions make affordable, quality public education difficult to provide (retrieved August 17, 2015 from https://www.cia.gov/library/publications/the-world-factbook/geos/jm.html, and https://en.wikipedia.org/wiki/List_of_countries_by_GDP_%28nominal%29_per_capita).

The current Jamaican educational system evolved from the British model, following the abolition of slavery in Jamaica in 1838. In Jamaica, quality education has always been 'exclusive', and available to a privileged few, while the masses have been provided with an inferior standard of education. Historically, it was the churches which provided basic reading, writing, and training skills to equip the ex-slaves to work independently of the sugar estates. Today, the Government of Jamaica provides and maintains the bulk of the educational facilities and training programs, but with severely limited financial resources. The literacy rate stands at approximately 88%. The median age of the Jamaican population is approximately 24 years of age, with just over 28% of the population being in the 0 – 14 years old range, and just under 64% in the 15 – 64 years old range, the government will be challenged for some time to come if it is to meet its declared objective of universal secondary and accessible tertiary education for all Jamaicans (retrieved August 17, 2015 from https://www.cia.gov/library/publications/the-world-factbook/geos/jm.html).

Ministry of Education

The Ministry of Education (MOE), formerly the Ministry of Education, Youth and Culture, and Ministry of Education and Culture, is the bureau established by the Government of Jamaica (GoJ) to oversee the development, delivery, and management of all formal public education related programs on the island. The mission statement of the MOE is "To provide a system which secures quality education for all persons in Jamaica and achieves effective integration of education and cultural resources in order to optimize individual and national development." (Retrieved August 4, 2011 from http://www.moec.gov.jm/faq.pdf)

The following latest available data relates to the 2009/2010 academic year, as reported by the Statistics Section of the Planning and Development Division of the Ministry of Education (MOE). There are four recognized levels within the Jamaican educational system: (a) Early Childhood, (b) Primary, (c) Secondary, and (d) Tertiary. There are 1,021 public owned or aided institutions, with 672,995 students enrolled across all four levels. Within the four levels of education there are ten types of public educational institutions: (a) infant, (b) primary, (c) all-age, (d) primary and junior high, (e) junior high, (f) special, (g) secondary high (includes traditional high), (h) technical high, (i) agricultural high, and (j) tertiary. Early childhood level education includes type (a) institutions; primary level education incorporates types (b), (c), and (d) (Grades 7 – 9) institutions; while secondary level institutions integrate types (c), (d) (Grades 10 – 11), (e), (g), (h) and (i). (Retrieved from http://www.moec.gov.jm/EDUCATION%20STATISTICS%202009-2010.pdf on August 4, 2011).

The early childhood level. The function of early childhood education is "To provide early stimulus in building interests in and positive dispositions towards learning" (Ministry of Education, 2001). Early Childhood education caters to children between the ages of 3 – 5 years old. During 2014/2015 there were 197,142 students enrolled in 2,660 public or government aided early childhood or infant schools and departments. The Government of Jamaica spent a total of J$2,700,000,000 (~US$31,213,873), approximately 3.72% of its total allocation on early childhood education. (Retrieved from http://www.moec.gov.jm/EDUCATION%20STATISTICS%202009-2010.pdf on August 17, 2015).

The primary level. Primary education addresses the learning needs of children between the ages of 6 – 11 years, and incorporates Grades 1 – 6 of the Primary, All-Age, and Primary and Junior High schools. It is in the Primary schools that the foundations for the acquisition of knowledge, skills and values for personal development and continuing education are fostered (Ministry of Education, 2001). For the period under review, public expenditure was J$22,760,000,000 (~US$26,312,138), or approximately 31.3% of the total budget of the MOE. There were 285,145 children enrolled at the public primary school level. (Retrieved from http://www.moec.gov.jm/EDUCATION%20STATISTICS%202009-2010.pdf on August 4, 2011).

Jamaican primary school students are often placed in overcrowded classrooms which lack the requisite resources to meet the needs of all their students. Under such conditions, very few are explicitly taught adequate reading-comprehension strategies. Although it has been known since

the mid-nineteen seventies that reading-comprehension strategies can be taught (Serran, 2002), and as early as at Grade three (Palincsar and Brown, 1986; Rosenshine and Meister, 1994), reading-comprehension strategies are not directly taught as a part of the reading curriculum. The current data indicates that only 37% of the boys, and 55% of the girls are reading at their grade levels in the primary school system (retrieved on August 17, 2015 from www.moey.gov.jm/sites/default/files/HMEsectoralD21.pdf and www.moey.gov.jm/sectoral-presentation-2015-2016).

The secondary level. Secondary level education and training prepares students for further education or employment (Ministry of Education, 2001). Secondary education was offered to 236,949 students between the ages of 12 – 16 years (age 18 years in selected schools with sixth-forms), incorporating Grades 7 – 11 (or 13 in some instances). The total budgetary allocation for Secondary/Vocational education was J$23,730,000,000 (~US$27,433,526), or some 32.7% of the total MOE budget, just under 4.25% of the national budget. (Retrieved from http://www.moec.gov.jm/EDUCATION%20STATISTICS%202009-2010.pdf on August 4, 2011). For the 2015 regional Caribbean Secondary Education Examinations (CESC), the English Language pass rate is 64% (42% if the entire Grade 11 cohort is considered). Indeed, Jones-McKenzie (2013, unpublished dissertation) citing data from the MoE notes that "…between 2007-2012, the average pass rate for CXC English A is 52.9% with a high of 64% in 2010, and a low of 43.5% in 2008" (p. 12).

The tertiary level. There are 17 registered public tertiary institutions operating in Jamaica, with a combined enrolment of 29,538 students, which excludes data from the University of the West Indies (Mona) which are unavailable. The expenditure on tertiary education and training for the 2009/2010 academic year was J$12,800,000,000 (~US$14,797,688), approximately 18.7% of the total budget of the MOE. This sum represents less than 2.3% of the total national budgetary expenditure during the period for which data is available (2009/2010). Furthermore, there were approximately 3,600 students enrolled in continuing education. However, continuing education is not considered to be a component of the tertiary education system. (Retrieved from http://www.moec.gov.jm/EDUCATION%20STATISTICS%202009-2010.pdf on August 4, 2011).

In addition, there are five dedicated public Teacher Training Colleges, and each of the remaining 12 tertiary institutions has a teacher-preparation or teacher-preparation related programs. There are also other private and off-shore institutions that offer additional teacher-preparation courses or programs too.

At the tertiary level, few lecturers are equipped to teach degree-seeking students with reading-comprehension challenges, and tend to apply an inefficient "one-size fits all" type of approach to content delivery. Thus many students struggle to achieve their true potential.

Special education. Special education is designed to meet the educational needs of students who are severely handicapped (*sic*), mildly retarded (*sic*), or exceptionally talented (Ministry of Education, 2001). It should be noted that special education, offered by type (f) institutions, was provided to some 3,370 students, between the ages of 4-18 years (limited infant, and primary through secondary levels), in selected government-owned and government-aided

special schools and units. The MoE estimates that between 15%-20% of the entire school population represents students with special needs (www.moey.gov.jm/sectoral-presentation-2015-2016

University Council of Jamaica

The University Council of Jamaica (UCJ) is the statutory body which has sole responsibility for quality assurance within the Jamaican tertiary education system. Established by the University Council of Jamaica Act in October 1987, this body operates under the aegis of the Ministry of Education. The UCJ establishes guidelines and procedures for tertiary institutions that are seeking accreditation of their programs. As a member of the Worldwide Network of Quality Assurance Agencies in Higher Education, and the International Advisory Groups, the UCJ periodically monitors the mission, goals, faculty, students, and levels of programs and resources being offered (University Council of Jamaica, n.d).

University of Technology, Jamaica

The University of Technology, Jamaica (UTech), is a technological higher education institution registered by the UCJ as a tertiary institution. UTech provides technical and professional education and training for Jamaica and the Caribbean. It originated in 1958 as the Jamaica Institute of Technology (JIT). In 1959 the JIT was incorporated as a tertiary institution, the College of Arts, Science, and Technology (CAST), and was subsequently validated by an Act of Parliament in 1964. Another Act of Parliament in 1986 upgraded CAST to a degree granting institution, and in 1995, CAST was accorded university status as "UTech", the first wholly Jamaican owned public university, and the only technological university in the English-speaking Caribbean. UTech currently has a student population of over 10,000 students, and offers approximately 100 different certificates, diplomas, and degrees by a variety of delivery modes (part-time, full-time, day-release, modular, summer, and via distance education). The philosophy of UTech states that it is committed to life-long learning, personal development, and service to the community, with a focus on excellence in teaching, research, and outreach (University of Technology, Jamaica, n.d.).

Faculty of Education and Liberal Studies

The Faculty of Education and Liberal Studies (FELS) is one of five faculties at UTech, and evolved from the Technical Education Department (Tech. Ed.) of CAST. "Tech. Ed." is the result of a grant and loan from the Canadian International Development Agency (CIDA) in 1971-2, geared towards the preparation of technical teachers in Secretarial Studies, Business Studies, Home Economics, Construction Technology, Electrical Technology, and Mechanical Technology for the upper levels of the secondary school system. Tech. Ed. also functioned as a resource center in the field of instructional aids and materials (retrieved on August 4, 2011 from http://www.UTechjamaica.edu.jm/colleges_faculties/fels/index.html).

FELS is comprised of the School of Technical and Vocational Education (SOTAVE), and the School of Human and Social Sciences (SHSS), formerly the Department of Liberal Studies (DOLS), and prepares technical and vocational teachers and trainers for the secondary and post-secondary schools throughout Jamaica and the wider Caribbean, offering primarily Bachelor of Education (B.Ed.) degrees since 1999. In September 2001 the B.Ed. degree was superseded by the B.Ed. in Technical and Vocational Education and Training (B.Ed. TVET) degree. SHSS is a

service department within the faculty, providing the university community with courses in the liberal arts, which includes some of the pedagogical components of the B.Ed. programs (retrieved on August 4, 2011, from http://www.UTechjamaica.edu.jm/colleges_faculties/fels/index.html).

The Faculty goals include the advancement of the mission of the faculty through research, programme (*sic*) development, instructional innovation, and the creation of "…an optimum environment for learning, instruction and research for staff and students." (Retrieved on August 4, 2011, from http://www.UTechjamaica.edu.jm/colleges_faculties/fels/index.html).

School of Technical and Vocational Education

The technical teacher-education programs at UTech are offered through the School of Technical and Vocational Education (SOTAVE). The goals of SOTAVE include preparing graduates who are able to effectively teach within their technical areas of specialization at the secondary and lower tertiary levels, who are professionals, who understand the importance of technical and vocational education in national development, and who are able to apply their technical knowledge and skills to solve real world problems (retrieved on August 4, 2011 from http://www.UTechjamaica.edu.jm/colleges_faculties/fels/index.html).

There are three broad categories of specialization within the school: (a) Business and Computer Studies, (b) Family and Consumer Studies, and (c) Industrial Technology. The Business and Computer Studies program has three sub-areas of specialization, namely: (i) Business Studies, (ii) Computing and Accounting, and (iii) Office Systems and Technology. The Family and Consumer Studies has three sub-areas of specialization: (i) Family and Consumer Studies, (ii) Food Service Production and Management, and (iii) Apparel Design, Production, Textiles and Management). The Industrial Technology Program also has three sub-disciplines: (i) Construction Technology, (ii) Electrical Technology, and (iii) Mechanical Technology (retrieved on August 4, 2011, from http://www.UTechjamaica.edu.jm/colleges_faculties/fels/index.html). This study will investigate the impact of reciprocal teaching on the first-year Industrial Technology students, with a view to expand its application at a later date, should it prove to be effective.

Industrial Technology Program. The Industrial Technology (Industrial Tech. or IT) program is geared towards preparing technical teachers and trainers to teach within the three areas of specialization identified. Even within these broad classifications, students may focus on narrower fields of specialization. However, they are prepared to teach across the wider spectrum of technical courses such as Wood Technologies and Architectural Drafting, Electrical Power and Electronics, and Mechanical Fabrication and Welding (retrieved on August 4, 2011, from http://www.UTechjamaica.edu.jm/colleges_faculties/fels/index.html).

This study was proposed to be completed within the three Industrial Technology options, and so no further effort was made to describe the programs outside of Industrial Technology, as this description represents the elemental level of the Faculty's structure.

CHAPTER II
REVIEW OF LITERATURE

Chapter two provides a review of the related literature pertinent to the theoretical bases for the completion of this study. It examines current learning theories, including metacognition and reading and comprehension, and incorporates text-readability and reading-levels. The reciprocal teaching methodology and its four components are examined in detail, along with comprehension fostering and monitoring strategies, and the role of expert scaffolding in strategy implementation. It also includes the theory behind the design of cloze test assessment instruments, scoring them, and the correct interpretation of the cloze test results.

Learning Theory

The seminal report *How People Learn: Brain, Mind, Experience, and School* (Bransford et al. (Eds.), 2000), a research-based publication on the mechanics of effective teaching and learning strategies, seeks to address the importance of applying the science of learning to classroom practice in a productive manner. It presents a "new theory of learning" (Bransford et al, (Eds.)), which reflects all the principles of *Constructivism*, an ideology based on the premise that learners use existing knowledge to actively construct new knowledge and meaning, based on their current individual and social experiences (Doolittle and Camp, 1999). According to Bransford et al, (Eds.), the ultimate aim of learning is to empower learners to become "…self-sustaining, lifelong learners …helping individuals achieve their fullest potential" (p. 5). However, it is felt that the current formal educational environment is not developing their talents successfully, and that there needs to be a new approach to teaching and learning in the classroom.

To this end, Bransford et al. (Eds.), (2000) advocate for *active learning* in the classroom, stressing the importance of "…helping people take control of their own learning" (p. 18). "People must learn to recognize when they understand and when they need more information." This *self-assessment* of effective learning strategies and evidence of understanding is known as *metacognition*, to be developed later in this review of literature. Suffice it to say that active learning should result in a greater understanding of information presented, and the ability to retain and transfer this understanding to novel settings. Learners should know when they understand information, or when they require additional clarification. This will require "…rethinking what is taught, how it is taught, and how it is assessed" (p. 13), a dynamic appraisal of the curriculum and the teaching and learning processes.

Serran (2002), referencing a quote from Scardamalia and Bereiter (1991), states that, consistent with constructivist theory, "…*formal* learning occurs only when learners approach a task with a clear purpose and intention to think, to find out something, to know something they did not know before" (p. 9, *italics supplied*). Thus formal learning is an intentional activity in which both the teacher and the learner collaborate. As the proverb says, "If the learner did not learn, the teacher did not teach" (*source unknown*).

How People Learn: Brain, Mind, Experience, and School presents three key findings that have "…both solid research base to support them and strong implications for how we teach" (p. 14). Of particular interest at this time is key finding number three: "A "metacognitive" approach to instruction can help students learn to take control of their own learning by defining learning

goals and monitoring their progress in achieving them" (p. 18). However, in order to analyze the implications of this key finding, we need to develop on the concepts of cognition and metacognition first.

Cognition and Metacognition

John H. Flavell (1977, p. 2) described cognition as "…what you know and think," and as the "… intelligent processes and products of the human mind." Cognition encompasses terms such as knowledge, thinking, strategies, and conceptualizing, to name a few. Cognitive theorists describe successful learners as active participants in the learning process, and learning itself to be an interactive process between the teacher, the students, and the text or content (Clarke, 2003).

The term "Metacognition" is attributed to Flavell, who, in 1979, expounding on his earlier concepts of "metamemory," defined metacognition as "…thinking about thinking, cognition of cognition…," and the "…knowledge and cognition about cognitive phenomena" (p. 906). Flavell (1979) also defined metacognition, what he then described as a "fuzzy" term, as the "… experiences and knowledge we have about our own cognitive processes." Schraw and Dennison (1994) described metacognition as "the ability to reflect upon, understand, and control one's learning." (p. 460). Schwartz and Perfect (2002) recognized two schools of thought regarding metacognition, each aligned to the domains of cognitive and developmental psychology. Today, metacognition is an important discipline within both fields of psychology.

Metacognition is a construct that is currently achieving a lot of attention from cognitive development researchers (Kuhn and Dean, 2004). There is also a lot of ongoing research on a variety of "meta-'s," not to be confused with "meta-analyses." Within the fields of the cognitive sciences, the prefix "meta-" implies that one object is applied to another object of the same kind, with the noun after the prefix identifying the object (Pitrat, 2004, p. 228). Thus, for example, "meta-cognition" literally translates to "cognition of cognition," and "meta-knowledge" the "knowledge of knowledge," definitions that are frequently employed in current literature.

Livingston (1997) described 'cognition' as obtaining knowledge, and cognitive strategies as being used to attain an objective (e.g. understand a passage). Livingston also describes 'metacognition' as a way of monitoring one's comprehension, and metacognitive strategies as being used to ensure that an objective has been met. The same author also claims that both strategies are interdependent.

Metacognition is a conscious activity on the part of the learner. Baker and Brown (1984) disclaim any unconscious, automatic activity as being metacognitive, as they believe an individual must be aware of and in control of his or her actions for it to be 'metacognitive.' This state differentiates successful metacognitive learners from less successful learners. Metacognitive learners are (i) aware of their comprehension levels, and (ii) have a variety of strategies to help them master any desired content. Such learners recognize the skills, resources and strategies that are needed to comprehend the text, and they utilize self-regulatory measures to attain a high level of comprehension (Baker and Brown, 1984). They plan, sequence, and monitor their learning, often utilizing several strategies, and resulting in an improved performance (Artz and Armour-Thomas, 1992).

Good readers read automatically when comprehending, subconsciously monitoring themselves. Monitoring, according to Haller et al. (1988) implies checking for reading-comprehension, and includes relating details to main ideas, the making of predictions, and evaluating and confirming these assumptions. Once a problem arises skilled readers detect it, and adopt a suitable strategy to overcome it (Baker and Brown, 1984). Thus metacognitive learners have the ability to monitor themselves in addition to being able to invoke the requisite cognitive processes for learning to take place. Poor readers lack this metacognitive awareness (the ability to identify the cause of one's lack of comprehension, be it vocabulary or background deficiencies, authors' presentation style, or the absence of implicit or explicit ideas, Haller et al., (1988), as cited in Clarke (2003), and capability, and are therefore unable to trigger any appropriate corrective strategy. Some poor readers, unaware of their lack of comprehension, make no effort to correct their deficiencies. Others, who might be aware, lack the appropriate strategies to effect a change of status, and are powerless to improve themselves.

Metacognition is the application of cognition and metacognitive strategies. Livingston (1997) notes that knowledge of metacognition and metacognitive strategies may be used to guide teachers how to design effective instructional programs, and that some learners are naturally more metacognitive than others. Such students tend to be the more successful learners. However, metacognitive skills can be developed if the learner is taught the strategies and given adequate opportunities to practice them.

Reading, as defined by Lesgold and Welch-Ross (2012), is the comprehension of language from a written code that represents concepts and communicates information and ideas. Reading is a cognitive process that requires an understanding of language, memory, and attention. Effective reading is more than the fluent decoding of words, but includes assessing the meanings of single printed words, as well as comprehending larger stretches of text (Garner, 1987). By means of their metacognitive skills, "good readers" are also "good comprehenders" (Golinkoff, 1975-6, pp. 628-9). They are able to decode accurately and rapidly, and obtain meaning from the context of the passages. By comparison, poor comprehenders are typically poor decoders, or lack strong vocabulary skills, and are inefficient at obtaining meaning from textual passages.

Students with effective learning strategies can measure their own progress towards specific goals, and have an increased self-awareness, increased personal control, and a positive self-evaluation (Cawelti, 1995). Being aware of what goes on in one's mind during learning is a critical first step to effective independent learning and achievement. Flavell (1979) asserts that "…young children are quite limited in their knowledge and cognition about cognitive phenomena, or their *metacognition*, and do relatively little monitoring of their own memory, comprehension, and other cognitive enterprises" (p. 906). Some students lack this self-awareness even at the tertiary level, and must be taught to monitor and regulate their own learning. The term 'regulate' implies the use of compensatory techniques such as rereading, skimming and scanning, as well as self-questioning (Haller et al., 1988 as cited in Clarke, 2003). Studies (Palincsar and Brown, 1984; Rosenshine and Meister, 1993, 1994; Schraw, 1998) show that students can be taught to be metacognitive with positive effect. The Reciprocal Teaching (RT) strategy is one method of teaching learners how to learn efficiently. Its use of modeling, guided practice, and application regularly report results in improved student achievement (Rosenshine and Meister, 1993, 1994).

Lightweis (2013) asserts that there is sufficient empirical research for college instructors to implement reciprocal teaching in their classrooms, and that faculty need to teach their students how to become self-regulating learners. Lightweis also states that faculty should provide support and encouragement towards their students, both in and outside the classroom environments. Then the faculty can expect the learners to become independent learners, the long-time goal of meaningful education.

Clarke (2003) is of the view that even students who display metacognitive abilities need timely reminders to reinforce these skills. Metacognitive skills have been demonstrated in children as young as five years old, and definitely improve with age, maturity and practice. Furthermore, if younger readers acquire metacognitive skills, they will develop into better reading-comprehenders as they transition through the educational system, thereby transferring the responsibility of learning from the teacher to the learners at an early stage of their development. This is when the learners become successful, independent learners (Brown, Campione, and Day, 1981). Clarke is also a proponent of explicitly instructing the learners into acquiring and practicing the reciprocal teaching strategies to promote their independent and automatic use of them.

Flavell (1987) identified two broad classifications of metacognition, (a) *knowledge of cognition*, and (b) the *regulation of cognition*. Knowledge of cognition includes (i) declarative knowledge, or what the students know about themselves and available strategies, (ii) procedural knowledge, or knowing how to use these strategies, and (iii) conditional knowledge, knowing when and why the strategies may or may not be used. Regulation of cognition, or the control of learning, is concerned with (i) planning, (ii) information management strategies, (iii) comprehension monitoring, (iv) debugging strategies, and (v) the evaluation of learning.

Nelson and Narens (1990, 1994) also postulated that there are two independent but interacting components to metacognition. They labeled them *monitoring* and *control*, and proposed the theories of metacognitive monitoring and metacognitive control. In this model, there are at least two levels at which a system operates, an object-level, and a meta-level. The object-level incorporates an individual's actions and behaviors, as well as the external state of the present situation. This snap-shot in time represents a static process. The meta-level is a guided, dynamic process, which assesses the current situation with a view to improve or maintain it. Each level provides the other level with an input. Information is transferred between these two levels as the system processes and reacts to a given situation. Figure 1 (see overleaf), an adaptation of Nelson and Narens' (1990, 1994) model shows a graphical representation of a two-level system and their information-transfer directions.

In the Nelson and Narens (1990, 1994) model, the flow of information from the object-level to the meta-level is termed *monitoring*, while the flow from the meta-level to the object-level is termed *control*. "Metacognitive monitoring is those processes that allow the individual to observe, reflect on, or experience his or her own cognitive processes" (Schwartz and Perfect, 2002, p. 4). Son and Schwartz (2002) describe monitoring as "… the ability to judge successfully one's own cognitive processes" (p. 15). Metacognitive monitoring informs the learner just how well they understand the information presented.

Metacognitive control, on the other hand, includes the *decisions* a learner makes at the object-level, both conscious and unconscious, once he or she has been provided with information regarding his or her degree of understanding from the meta-level, which is influenced by the general goal of initially acquiring the information (Schwartz and Perfect, 2002). Son and Schwartz (2002) describe this control as the ability to use those monitoring judgments to alter one's behavior, both during learning and remembering.

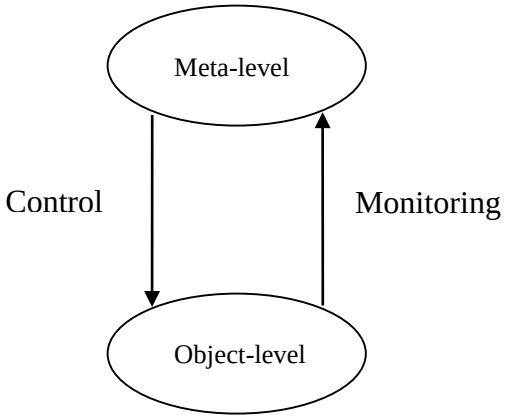

Figure 1.1. Showing the relationship between metacognitive control and metacognitive monitoring with respect to the object-level and the meta-level. Adapted from Nelson and Narens (1990, 1994, p. 11).

One question that researchers of metacognition have sought to answer is, Can metacognition be learned, or is it an intuitive process? Son and Schwartz (2002) believed this question to be of great importance, with the potential to impact on the educational applications of metacognition. If a learner believes that he or she understands a data set, and will retain it in their long-term memory, the learner will proceed to another activity. However, should the learner be uncertain of their ability to replicate the data, they may elect to reinforce the data set in some selected and strategic way until they are satisfied that they have mastered the content. Therefore, if a learner can adequately master his or her control processes, he or she could be able to take responsibility for his or her own learning (one of the goals of Constructivism), develop appropriate learning strategies, and use these strategies to positively impact their learning and retention levels. This in turn should result in an improved academic achievement level.

In particular, and writing out of Belgium, Romainville (1994) expressed concern for the high failure rate among first-year students at the university level. Romainville noted that "to learn" is not synonymous with "to succeed," as some students succeed at university but did not acquire lasting knowledge (p. 359). Romainville also noted that there is a relationship between students' metacognitive knowledge characteristics and their academic achievement levels, with high achieving students being aware of, and able to utilize more metacognitive strategies than their lower achieving colleagues. In addition, Romainville observed that successful students were more structured and hierarchically organized in their metacognitive knowledge. Previously Vygotsky (1978) had determined that the conscious reflective control of, and the deliberate mastery over one's metacognitive abilities were essential factors of successful school learning.

Therefore, it seems important to investigate the impact of imparting metacognitive skills to students who are not yet aware of, or have not yet developed them.

Metacognition as Metacognitive Monitoring and Metacognitive Control

Son and Schwartz (2002) agree that metacognition is comprised of the interaction between monitoring and control on the part of the learner, claiming that they are mutually interdependent. The learner cannot make any meaningful strategic effort unless he or she is accurately monitoring his or her own degree of comprehension. The authors also agree that self-monitoring occurs before information retrieval, either before or during ongoing learning and retention, and while the control process occurs during the ongoing learning and retrieval processes.

Ignorance of Incompetence

Commenting on the idea of the 'ignorance of incompetence,' or the lack of self-awareness of their own intellectual and social deficiencies, Dunning et al. (2003) construe that "…people tend to be blissfully unaware of their incompetence" (p. 83). Dunning et al. also conclude that "…Their lack of skill deprives them not only of the ability to produce correct responses, but also of the expertise necessary to surmise that they are not producing them" (p. 83). These authors also state that "… people are unaware of their incompetence, innocent of their ignorance. Where they lack skill or knowledge, they greatly overestimate their expertise and talent, thinking they are doing just fine when, in fact, they are doing quite poorly" (p. 85). Furthermore, individuals who are unable to produce correct answers are most likely to be unable to know what the correct answer is. This level of "… incompetence means that people cannot successfully complete the task of metacognition …the ability to evaluate responses as correct or incorrect" (p. 85). Hence, poor performers experience greater challenges making metacognitive judgments when compared with their more able colleagues. Citing Alfred North Whitehead (n.d.), Dunning et al. express that "… it is not ignorance, but ignorance of ignorance, that is the death of knowledge" (p. 86). Confucius (n.d.) is credited with making the same point centuries before when he allegedly said "Real knowledge is to know the extent of our ignorance."

Palincsar and Brown (1984) note that:

> …skilled readers will persistently allocate time and effort to the task of untangling comprehension failures, while less-skillful readers, in their opinion, do not seem to use monitoring strategies well, and do not seem to allocate the time and effort to clarifying comprehension failures through the use of deliberate and active processing strategies" (p. 27).

Reading and Comprehension

As noted by Lesgold and Welch-Ross (editors, 2012), successful reading requires a lot of effort and practice on the part on the reader. Successful readers intrinsically learn their responsibility to make this effort, and to apply adequate and sustained attention, concentration and persistence to the reading task. Less successful readers need assistance to attain mastery of this skill (Palincsar and Brown, 1984; Rosenshine and Meister, 1996).

In contrast, many 'inefficient readers' are really individuals struggling with different degrees of 'decoding' skills. Decoding, or the ability to apply the knowledge of letter-sound relationships

(i.e. phonological awareness), in conjunction with reading fluency, or the ability to read text accurately and with speed without overburdening one's brain's limited resources, are essential components of text comprehension.

Reading is typically understood to imply "the literal decoding of text symbols," a skill that is impacted by, and requires the reader to be competent, according to the Direct and Influential Mediation Model (DIME), in the skills of i) background knowledge, ii) word-reading, iii) vocabulary, iv) strategies, and v) inference procedures (Cromley and Azevedo, 2007, as cited in Lesgold and Welch-Ross (eds.), 2012). However, observation and anecdotal evidence suggest that many 'decoders' (as in the context of this study) do not fully understand the intent and purpose of the authors text, especially expository text, and therefore do not grasp the significance of the text in a meaningful manner. Such readers are deemed 'good decoders' but 'poor reading comprehenders'. In an environment where a vast amount of critical information is transferred via the text format, and which the reader is expected to be able to absorb independently, poses a major challenge, and serves to limit the achievement potential of such individuals. The reciprocal teaching strategy is deemed to be an effective strategy for use with such individuals (Palincsar and Brown, 1984, 1986; Rosenshine and Meister, 1994).

The proficiency of 'comprehending reading' is a complex act which implies more than the ability to decode text, and has traditionally been considered a cognitive process, in which the use of cognitive skills such as the knowledge of language, memory, and attention combine to determine the learner's decoding *and* comprehension skills (Garner, 1987). Harris and Sipay (1985) as cited in Serran (2002) identify i) perception, ii) decoding skills, iii) prior knowledge of the subject, and iv) reasoning capability in their list of influential factors of reading-comprehension. With the emergence of metacognitive ideas, Garner presents the belief that efficient learners can and must be aware of, and take control over their cognitive activities. Therefore, metacognition forcefully impacts on one's text comprehension capabilities.

The theory of effective reading-comprehension, as described by Lesgold and Welch-Ross (editors, 2012) requires adequate and sustained attention on the part of the readers, who must focus their efforts on fluent, relatively automatic decoding, thereby allocating significant portions of their mental resource capacity to developing meaning and understanding from the text, and to concentrate and sustain memories of previous text before the next text is read. Poor comprehenders, by contrast, utilize significant portions of their cognitive energies just to decode the current text, and are less able to understand the global passage being read.

Furthermore, good comprehenders are successfully able to assimilate information from a variety of sources (textual, non-textual, and background knowledge), a process which typically distracts poor comprehenders.

Reading-Comprehension.

McLaughlin (2008) argues that reading-comprehension is impacted by phonemic awareness, phonics, fluency, and vocabulary, and together these four components comprise the building blocks of literacy. Citing the definition of reading-comprehension provided in *The Literacy Dictionary* (Harris and Hodges, 1995), reading-comprehension is proposed to be "The construction of meaning of a written or spoken communication through reciprocal, holistic

interchanges of ideas between the interpreter and the message in a particular communicative context" (p. 39). This definition is consistent with Constructivist Theory and intentional cognitive processes influenced by the interpreter's prior knowledge and experience. Thus, reading-comprehension may not be accurate nor standardized across a group of readers.

Spiro (1980) concurs that reading-comprehension is a constructive process, stating that:

> …explicit information in a text is insufficient for the specification of the meaning of that text. Rather, the complete meaning is *constructed* by combining information from various sources that comprise the context of the text, e.g. prior knowledge, linguistics, situational, and task contexts. It is this act of combining information to produce a text's understood meaning that is referred to as *construction* (p. 2, *italics supplied*).

McLaughlin (2008) further describes reading-comprehension as being trans-disciplinary, as every academic discipline depends on reading, and consequently reading-comprehension. Hence, all disciplines should have a vested interest in improving and maintaining widespread reading-comprehension skills. However, McLaughlin proceeds to cite the lament of Pearson (2001) who opines that what is now known about teaching comprehension strategies is not making its way to the classroom teachers and into the classrooms, suggesting the need to implement into practice the theoretical information that has been generated by pertinent researchers.

Blazer (2007) seeks to identify at least four specific reasons why many students lack effective reading-comprehension abilities: i) explicit reading strategy instruction is not provided in all content areas, ii) students are not taught how to implement cognitive strategies for each type of text, iii) the overuse of traditional teaching practices, which students do not always find interesting nor inspiring, and iv) teachers, in pursuit of national assessments, do not have adequate time and resources for the requisite intensive strategy instruction. This results in too little time being available for student practice or feedback, in an environment that has reduced time available for reading due to 'technologies' such as the internet and educational videos.

Kahre et al. (1999) also state that students lack instruction in strategy use for self-monitoring of their reading-comprehension, and that they need to be taught to use specific strategies to construct meaning from text. Rosenshine and Meister (1994) state that "…until the late 1970's students were seldom taught cognitive strategies that could assist them in reading" (p. 479), which in part could explain the widespread problem of low reading achievement. Rosenshine and Meister's research indicate that teachers spend a lot of time questioning their students about their reading-comprehension, but rarely teach them effective comprehension strategies. Fielding and Pearson (1994) agree that reading-comprehension is a skill that should be taught directly to all students from an early age, and that specific and adequate time must be allocated for the purpose of reading, which should include opportunities for peer and collaborative learning, as well as with occasion for teacher-to-student and student-to-student interactions. Such activities need to be practiced on a regular basis until they are internalized by the students. The teachers' specific responsibility is to provide feedback, modelling, coaching, hints, and explanations on the use of the strategies introduced.

Despite the recent 'richer, deeper, and fuller' qualitative gains in understanding the mechanics of reading-comprehension, McLaughlin (2008) advises that due consideration must be given to the

varying and complex natures of the readers, and the evolving nature of the text, being driven by emerging technological advances. Consideration should also be given to the intricate context in which learning takes place, and to the need to 'curricularize' reading-comprehension strategy instruction. In other words, to make it a part of every school's curriculum so all students will have access to strategy instruction (Pearson, 2001). McLaughlin also advocates for reading-comprehension to be viewed as a continuous, life-long learning process, in conjunction with the need for new and more effective models of teaching reading-comprehension, as no one omnibus approach would be adequate for all learners in all contexts. Implicit in these conclusions is the premise that there is still much more for researchers to learn, and that reading-comprehension as a field of study will continue to evolve in the foreseeable future.

Expository Text

Textbook materials, at least at the tertiary level, tend to be predominantly expository in nature. Narrative texts are common at the early educational levels, but the transition is made to the expository style at the secondary and post-secondary educational levels. Pagés (n.d.) posits that the expository writing style found in tertiary level textbooks has definite characteristics, and is written specifically to inform, describe, explain, or persuade the reader, and to make reading and reading-comprehension easier. For the optimum transfer of information via expository text between a writer and an audience, the writer needs to conform to the standards, and appreciate the readability limitations of the text (Stephens, 2000). Unfortunately, students with poor reading-comprehension skills frequently ignore some of the salient features that are incorporated within the expository style of writing. This often results in them making their tasks of reading and reading-comprehension much more challenging. When utilized properly, the typical features of an expository text assist the readers in increasing their focus on, and comprehension of the content, and augments the extent to which the reader interprets and retains the selected material and learns the information. According to Pagés, this is important, as the way students learn affects their ability to comprehend, remember, and reproduce the information.

Specifically, Pagés (n.d.) identifies six main features employed in the expository text style of writing, where each discrete function aims to aid the reader in the comprehension of the expository content:

(i) chapter divisions, introductions and summaries
(ii) chapter questions and section questions
(iii) headings and sub-headings
(iv) typographical features such as bold-face and italics type, captions, the use of color, and notes in the page margins
(v) the often copious use of graphs, tables, diagrams, maps, and other graphic aids and supplemental materials in addition to the plain text
(vi) the inclusion of a table of content, an index, a glossary, and an appendix.

It should be noted that not all textbooks will include every feature, and that some textbooks incorporate other unique features of their own. However, all good (i.e. effective) textbooks take the characteristics of the typical reader into consideration, and incorporate a combination of features in conjunction with appropriate readability features to produce a reader-friendly product.

Lapp et al. (1995), citing seminal works by Meyer et al. (1980), whose research reveals that readers who are unaware of text structure read without a purpose, and attempt to retrieve information in a seemingly random manner. Gersten et al. (2001) state that "… expository text often is so dense with information and unfamiliar technical vocabulary that students must perform fairly complex cognitive tasks to extract, summarize, and synthesize its content" (p. 297). Gersten et al. conclude that awareness of text structure is acquired progressively, with expository text being harder to appreciate than narrative material, that some texts are easier to comprehend than others, and that the knowledge and use of text structure is important to comprehending expository text.

Collectively, when adequate attention is paid to these textbook features, they serve to focus and enhance the readers' ability to dissect and internalize the text, resulting in an improved reading-comprehension level on the part of the reader. Duke and Pearson (2002) advocate that children, and by extension, implying *all* readers, be taught to use the structure of both narrative and expository texts to promote the comprehension and recall of the ideas that they present.

The Flesch Reading Ease (RE) Readability Formula

Developed in 1948 by Rudolph Flesch, this reading ease formula is considered to be one of the most accurate readability formulas, and is best applicable to school textbooks. The formula is used to assess the difficulty of a passage that is written in the English language. The Flesch Reading Ease Readability formula is given by:

$$RE = 206.835 – (1.015 \times ASL) – (84.6 \times ASW)$$

The output of the formula, which takes into account the average sentence length (ASL), as well as the average number of syllables per word (ASW), is a readability ease (RE) number ranging from 0 – 100. The higher this number is, the easier the passage being analyzed is to read. Using the *WebFerret* search engine and "readability formulas" as key words, the researcher identified the following ratings that allow for the direct interpretation of the Flesch Reading Ease Readability scores (ReadabilityFormulas.com, n.d.):

90 – 100	very easy (easily understood by an average fifth grade student)
80 – 89	easy
70 – 79	fairly easy
60 – 69	standard (easily understandable by eighth and ninth grade students)
50 – 59	fairly difficult
30 – 49	difficult
0 – 29	very confusing (easily understood by college graduates)

The Flesch-Kincaid Grade Level Readability Formula. The Flesch-Kincaid Grade Level Readability Test was co-developed by Rudolf Flesch and J. Peter Kincaid in 1976, and is an extension of the Flesch Reading Ease Readability formula. The grade level formula is quite suited for use in the field of education, and factors the average sentence length (ASL) and the average number of syllables per word (ASW). The formula is given by:

$$F\text{-}KRA = (0.39 \times ASL) + (11.8 \times ASW) – 15.59$$

where F-KRA is the Flesch-Kincaid Reading Age, or Reading Grade Level. Interpreting the F-KRA is quite simple, as an F-KRA score of say 9.7 means that a ninth grader in the USA educational system would be able to read *and comprehend* the context of the passage. Thus, stakeholders are readily able to evaluate the readability levels of the prescribed reading materials they assign to their students across all levels of the educational spectrum, based on the North American educational standards (Stephens, 2000).

Both the Flesch Reading Ease Readability and the Flesch-Kincaid Grade Level Readability formulae are standard readability formulae used by many US government agencies. Furthermore, both of these formulae are inbuilt within the MS-Word application for personal computers. However, it should be noted that some earlier versions of MS-Word report any score above Grade 12 as a Grade 12 level (ReadabilityFormulas.com, n.d.).

Adult readers defined. In the legal fraternity and social framework, an 'adult' is typically accepted to be an individual who has attained the 'age of majority,' 18 years or older in both Jamaica and the United States of America (with a few exceptions elsewhere). At the 'age of majority' an individual acquires control over his or her person, decisions and actions. *Wikipedia* (n.d.), the free online encyclopedia, associates an adult with a human being who is mature, or who has attained sexual (i.e. reproductive) maturity. However, Carver (2000) defines an adult reader as being an eighth grader or older (in the USA educational system), that is, over approximately 13 years of age and having a normal education. By this definition, all of the participants involved in this study are 'adult readers,' having attained developmental maturity and completed their secondary education (Grade 11). Hence, chronological age is not a mitigating factor of this study.

Reciprocal Teaching

The works of Palincsar (1982), Palincsar and Brown (1984), and two meta-analyses by Rosenshine and Meister (1993 and 1994) comprise the main theoretical bases and analyses of this discussion of "reciprocal teaching." The variation of Reciprocal Teaching (RT) utilized in this study is a training method that involves four primary content-analyzing activities, (a) summarizing, (b) questioning, (c) clarifying, and (d) predicting (Palincsar and Brown, 1984), discussed in the order presented by the original authors.

Each RT strategy contributes towards the attainment of the goal of comprehending and retaining textual content. 'Summarizing' a passage reveals the readers' ability to review and assess whether the content has been understood, and is demonstrated by expressing the main idea(s) and most important details of the text in an abridged form. Most inexperienced readers have difficulty distinguishing between 'summarizing' and 'retelling', and need practice in this particular skill. 'Questioning' solicits the reader to generate and determine what main idea question(s) the teacher or a test might ask, in preparation for assessment activities, and to seek answers, sometimes inferring them from the passage. Hashey and Connors (2003) argue that the act of question-generation may lead to the deepest level of understanding and information recall, and that students need to be aware of the value of self-questioning in order to internalize the strategy.

'Clarifying' occurs only if there is confusion in the text or its interpretation. The efficient reader seeks an understanding of the text that does not make sense before proceeding to other concepts. If there is an obstruction to understanding the information, the reader should take the necessary action(s) to correct their learning (e.g. reread, consult a dictionary, ask knowledgeable others etc.). This act requires the learners to use metacognitive processes while monitoring their degree of comprehension. A 'Prediction' is made if clues embedded in the text can be used to suggest the direction of the content and what comes next. Making predictions (or intelligent guesses) provides reasons for reading the text and promotes discussion among the readers. Importantly, it should be noted that predictions do not have to be accurate all the time. As the reader grasps a better understanding of the text, they can always adjust their predictions accordingly to reflect their newly acquired understanding of the passage. These hypotheses or assumptions made serve to activate the readers' prior knowledge of the topic, and assist them in self-monitoring their comprehension levels.

The above-mentioned four strategies incorporated into the methodology of RT are not practiced in isolation, but rather are integrated into the reading process, as appropriate. Furthermore, the inability to perform any of these skills is not deemed to be a "failure" on the part of the learner, but rather is an important indicator of the need to take suitable remedial action in order to enhance one's reading-comprehension levels. Basically reciprocal teaching teaches poor comprehenders what good comprehenders automatically do on a consistent basis, how to construct meaning from the text, as well as to actively monitor their own comprehension levels. Reciprocal teaching results in a deeper understanding of what has been decoded, as the learners learn from and teach each other. (Gruenbaum, 2012; Hashey and Connors, 2003; Palincsar and Brown, 1984; Todd and Tracey, 2006).

First described by Palincsar (1982, unpublished doctoral dissertation, reported by Rosenshine and Meister, 1993 and 1994) and Palincsar and Brown (1984), the objectives of RT are to (i) aid the comprehension of textual content, and (ii) retain this understanding, enabling the reader to extract and process the information efficiently, and to reproduce it subsequently. The research literature typically suggests that the reciprocal teaching strategy is effective in *consciously* transferring good reading habits and facilitating meaning acquisition from the group instructor to and between the group members. Palincsar and Brown hypothesized that if it is known *how* people learn, then we can know how best to teach them. If the aim of educational research is to improve the teaching and learning processes, then it is worth further investigating the merits of RT. The authors also note that it is generally agreed that effective reading-comprehension is the product of "decoding fluency," or the ability and ease of interpreting word symbols, and three main factors: (a) considerate texts, (b) compatibility between the reader's knowledge and the content of the text, and (c) active strategies used by the reader to understand and retain the information, as well as to "circumvent comprehension failures" (p.118).

A "considerate text" is one which is well written, follows a familiar structure, has an acceptable syntax (i.e. sentence structure), style, clarity of presentation, and is coherent, that is, it is "reader friendly." Reading-comprehension is also influenced by the absence of information gaps between the reader's prior knowledge and the content being presented in the text (i.e. is compatible). Unless all gaps can be overcome, full comprehension will be impeded. Additionally, comprehension depends on the reader's use of appropriate strategies to assimilate the material,

where a strategy is defined as a process for enhancing comprehension and avoiding comprehension failures. Hence, a selected strategy must (a) enhance one's success in reading-comprehension, while (b) overcome all obstacles to comprehending the text (Palincsar and Brown, 1984).

The use of "active strategies" requires time and effort on the part of the learners, and distinguishes between "mature" or "expert" learners, and less successful readers. Mature learners are alert to their comprehension levels. When they understand the content, they are able to proceed "relatively automatically" (Palincsar and Brown, 1984). However, should there be too many unfamiliar concepts, or if their comprehension expectations are not being met, they are able to recognize this, and commit extra processing resources to enable them to apply strategies that assist them in mastering the content. Mature readers possess a variety of effective "active strategies" at their disposal, and their effort to increase their reading-comprehension levels is a *deliberate* one. This ability to monitor the degree of one's reading-comprehension performance, as described earlier, is termed *metacognitive awareness*.

Expert readers apply themselves differently when reading for pleasure as opposed to "studying' (Palincsar and Brown, 1984). At the college level, students are expected to be able to "read to learn." Reading to learn implies reading to obtain content knowledge that they do not yet possess. Studying involves comprehending and memorizing the content, which requires implementing a learning strategy, and assessing the effectiveness of that strategy. Reciprocal teaching has been shown to be an effective reading-comprehension strategy using both expository and narrative texts, at all grade-levels as well as with all types of content (Rosenshine and Meister, 1994). It provides a positive, comfortable learning environment for teacher- and student-to-student learning in a non-threatening environment, which most students report to actually enjoy (Li and Kam, 2011).

Oczkus (2005) attributes the favorable impact of reciprocal teaching to its implementation of four critical "foundations," namely i) think-a-louds, in which individuals verbalize their thought processes, ii) cooperative learning, or the use of small interactive groups, iii) expert scaffolding, in which experienced practitioners model and guide the learners as is needed, providing them with additional feedback, and encouraging independent- and team-work, and finally iv) metacognition, the leader reviews how to use the reciprocal teaching strategies, reflects on the correct use of each strategy, and discusses its proper application in the reading-comprehension process. Oczkus also notes that it is critical to regularly model and practice the strategies with the students, and that these strategies can easily incorporate the students' textbooks (i.e. authentic texts), and that there is no one best way to deliver the reciprocal teaching methodology.

Oczkus (2005) identifies time management is another critical component when studying, as the reader must often decide what material is important, and what needs to be studied in the available timeframe. The ability to select and allocate appropriate resources to enhance one's reading-comprehension is termed *metacognitive control.*

Todd and Tracey (2006) describe reciprocal teaching as introducing students to reading-comprehension strategies, and instructing them why these strategies are important, how to perform them effectively, when and where to utilize them, and how to evaluate their

effectiveness. Citing Greenaway (2002), Todd et al. identify the goal of reciprocal teaching as being to make poor comprehenders aware of how the strategies work and how to use them. Scardamalia and Bereiter (1991) distinguish the subtle difference between reciprocal teaching and the more traditional question-and-answer teaching approach as…

> Reciprocal teaching perhaps contrasts most strikingly with conventional teaching in the nature of the activity toward which progress is aimed. In conventional question-answer teaching the implicit target is a question period in which the students all give accurate and thoughtful answers to *the teacher's questions*. (Teachers will, of course, have goals beyond this, but they would have to be realized in some other activity.) In reciprocal teaching the target activity is *a thoughtful discussion that the students carry on by themselves,* having gradually weaned themselves from dependence on the teacher to direct the discussion and to help them perform their roles in the discussion (p. 49, *italics added*).

Thus critical thinking and creative comprehension are the major goals of the use of reciprocal teaching, in which the teacher teaches the students how to learn (not just content), and the students learn how to learn (not just content). According to Norman (1980), teachers expect their students to learn and be life-long learners, which is not a mindless process at the tertiary level, but rarely teach them how to learn efficiently.

Comprehension-Fostering and Comprehension-Monitoring Strategies

Comprehension-fostering and comprehension-monitoring strategies are basic skills that apply to a wide range of knowledge-extending situations other than reading-comprehension (Palincsar and Brown, 1984). Citing their work in collaboration with Armbruster (Brown, Palincsar, and Armbruster, 1984), the authors identified six of the most important underlying activities for improving reading-comprehension levels:

(a) understanding the purpose of reading, both explicit and implicit
(b) activating relevant background knowledge
(c) allocating attention so that concentration can be focused on the major content at the expense of trivia
(d) critical evaluation of content for internal consistency and compatibility with prior knowledge and common sense
(e) monitoring ongoing activities to see if comprehension is occurring, by engaging in such activities as periodic review and self-interrogation
(f) drawing and testing inferences of many kinds, including interpretations, predictions, and conclusions.

Palincsar and Brown (1984) determined that four selected "key strategies" incorporated a combination of the six factors listed in (a) – (f) above. These strategies are:

(a) Summarizing (i.e. self-review) (which is incorporated in (a), (b), (c), and (e) above)
(b) Questioning (incorporated in (a), (b), (c), and (e) above)
(c) Clarifying (incorporated in (a), (b), and (d) above)
(d) Predicting (incorporated in (a), (b), and (f) above).

These four strategies were selected because they provided a dual function, that of enhancing (a) comprehension-fostering *and* (b) comprehension-monitoring activities, both of which are considered essential to improving reading-comprehension. It was also noted that these are the strategies that poor readers do not readily engage in successfully. Classroom teachers need to train good decoders but poor comprehenders to acquire and use these proven metacognitive strategies, otherwise they will continue to read texts emphasizing the words over their meaning (Choo, Eng, and Ahmad, 2011).

Reciprocal Teaching Approach

In RT (i) the focus is upon teaching students specific, concrete, comprehension-fostering strategies which they can apply to the reading of new text, and (ii) this instruction takes place primarily in the context of a dialogue between a 'teacher' and the students (Rosenshine and Meister, 1994). An effective instructional strategy must (i) entice the students to be actively involved in the learning process, regardless of their grade or ability levels, (ii) provide timely feedback on their progress, and (iii) inform the students why, when, and how they should use the strategy (Palincsar and Brown, 1984). The RT strategy meets these criteria, allowing the students to experience the joys of success in the learning process, while situating the strategy in an authentic classroom reading context. The authors also believe that implementing RT will allow the learners to retain the knowledge gleaned over time, to transfer it within conceptual domains, and be able to generalize the strategy to other settings.

The RT intervention is based on (i) expert scaffolding, and (ii) proleptic teaching, where proleptic means "in anticipation of competence" (Palincsar and Brown, 1984). In RT, the learners or "novices" are typically placed in small groups, under the tutelage of an "expert", the teacher, who invites and guides the group's interactions during the learning process, explicitly modeling the desired skills and activities to the group. Initially, the group members are unable to act independently. However, the expert anticipates the learning difficulties, and displays the requisite learning skills, gradually transferring the responsibility of thinking and learning to the novices as they acquire greater confidence and ability to replicate the practices. The students comment and elaborate on each other's summaries, questions, clarifications, and predictions, and help each other to overcome obstacles to learning and understanding (i.e. social learning). Over time, the expert relinquishes all responsibility to the learners, acting solely as a coach, at which point the students share and subsequently assume full responsibility for their own learning and practice of the strategies. The students are now "experts" within their own rights. Periodically, the learners rotate the leadership responsibility, so that each member of the group eventually has the opportunity to be the group-leader.

In addition, during the dialogue, students are provided with instruction in why, when, and where such activities should be applied to new text. Thus RT serves to (a) instruct and (b) provide practice in the four comprehension-fostering strategies (Palincsar and Brown, 1984; Rosenshine and Meister, 1994).

Social Development Theory and Expert Scaffolding

Vygotsky's (1978) *Social Development Theory* is at the heart of the philosophy of RT. Vygotsky believed that learner's mentally "construct" or develop knowledge acquiring skills by means of

"expert scaffolding," first in a social or public context, and subsequently on an individual or private level. This ideology is consistent with the philosophy of *Constructivism* (Doolittle and Camp, 1999), in which the learners shape their current knowledge to construct new ideas and understandings of the text (McAllum, 2014). An expert provides and models the 'scaffold' for the students arranged in small groups to emulate and gain proficiency. Social development implies that the learners acquire both knowledge and meaning from dialogue and interaction between each other along with the text, and that they assist each other in their own development when needed, learning and teaching what is being modeled by the expert. This creative socialization also encourages the learners to take a greater role in their own learning responsibility (Pressley, 1998). Through this interaction, the learners eventually are able to fulfill these functions independently via self-regulation and self-interrogation, and at their own rate in the presence of the expert. Initial participation and development occurs in stages, until full competence is achieved. However, there is a limit to what a learner may learn independently, and what may be learned with assistance. Vygotsky addressed this 'zone' in terms of his "social development" and "expert scaffolding" theories.

Zone of Proximal Development

Vygotsky introduced a concept of cognitive development which he referred to as the *zone of proximal development* (ZPD). Observing that children had two developmental levels, their (i) *actual developmental level*, at which they can independently handle assigned tasks, and (ii) *level of potential development*, or the level at which they can solve problems with the aid of a teacher, or in collaboration with other students, Vygotsky sought to address the gap between them. This "zone of proximal development" is the region between what an individual can intellectually accomplish unaided, and the extent to which that learner can achieve when guided by a more experienced person (Vygotsky, 1978). In any given domain, a learner may have a large zone of proximal development, implying that such an individual is ready to perform at a higher, more mature level, with some degree of support. Likewise, a small zone of proximal development indicates that such an individual is not yet ready to perform far beyond his or her unaided level.

Applying Vygotsky's principles of the *Social Development Theory* and the *Zone of Proximal Development*, as well as the practice of 'expert scaffolding,' a term "not used by Vygotsky" (Rosenshine and Meister, 1994, p. 484), Palincsar and Brown (1984) developed the RT strategy as an intervention to model and train students to expand their comprehension-fostering activities while guiding them to participate at an ever-increasing level of competence, and by eventually removing their support (i.e. the scaffold), allowing them to act independently.

Reciprocal Teaching Methodology

Palincsar and Brown (1984) depict RT as being similar to, but more extensive than "reciprocal questioning," that was developed by Manzo in 1968 (unpublished doctoral dissertation). The term "reciprocal" is used because the teacher and the students take turns in leading the dialogue about the text. However, Palincsar and Brown chose 'teaching' over 'questioning,' as their strategy included generating summaries, making predictions, and clarifying complex sections of the text in addition to asking main-idea questions. Furthermore, RT has a much greater emphasis placed on encouraging students to provide instructional support for each other, and on cooperative effort between the teacher and the students in bringing meaning to the text (Rosenshine and Meister, 1994).

The general format of RT as followed in this study has the group silently read a passage. Then the "leader" asks questions that the group could be quizzed about, while soliciting additional questions from the group members. Next the leader models the generation of a summary of the main idea(s) of the segment. Variations of the method have the group collectively composing the summary. Then, if there are any difficulties with the passage or its vocabulary, these are discussed and clarified by the group members until everyone is satisfied that they understand the reading. Finally, cues from the text are used to make predictions about the future content and direction of the text. One advantage of this strategy is that it may be delivered embedded as a natural dialogue between the teacher and the class as an authentic practice while teaching other content. Alternatively, the RT strategy may be taught as a general comprehension-fostering strategy, which features expert modeling, feedback and guided student-practice (Rosenshine and Meister, 1994).

Not only are these four sub-component strategies (i.e. summarizing, questioning, clarifying and predicting, the 'Fab Four' (Oczkus, 2010)) associated with the cognitive practices of successful readers with high reading-comprehension levels, they are notably absent among less capable comprehenders. The RT procedure impacts positively on the students' improved performances, enticing the participants, regardless of their cognitive levels, to be actively involved in the process. Thus the teacher can assess the competency levels of the students, and provide them with personalized feedback (Akkuzu, 2014; Palincsar and Brown, 1984).

Furthermore, the teacher and the students mutually assume responsibility for achieving the learning goals. As the students acquire greater proficiency in the practices, and their cognitive needs evolve, the teacher transfers more and more of this responsibility to the students. By frequently assessing and revising their individual needs, the teacher is able to diagnose the most effective method to explain to the learners, and model the strategies, all within a natural, interactive learning environment (Palincsar and Brown, 1984).

Checklist for 'Quality' Reciprocal Teaching.

In an effort to compare the quality of RT instruction across 16 selected studies, Rosenshine and Meister (1994) developed 8 criteria that they believed should be included in delivering RT. These criteria were employed to guide the design and delivery of the RT procedures utilized in this study:

1. Students are instructed in a repertoire of strategies (two or more) that they can use to help them better understand what they read.
2. The teacher models each of the activities.
3. Students are invited to make comments regarding the modeling and the passage, such as, "Was there more important information?" or "Does anyone have anything more to add to my prediction?"
4. Students are provided with guided assistance as they participate at whatever level they are capable in carrying out the strategies.
5. Teacher supports each child's participation in the dialogue through specific feedback, praise, prompting, additional modeling, paraphrases, coaching, hints, and explanation.

6. Teacher invites students to initiate discussion and to react to other students' statements. Such participation can include (a) suggesting other questions, (b) elaborating upon a summary, (c) commenting on another's predictions, (d) requesting clarification of material they did not understand, (e) offering additional comments on the content, and (f) helping to resolve misunderstandings.
7. During the reciprocal teaching procedures, there is a gradual shift from the teacher doing much of the work to the learner taking over the major thinking role. The teacher gradually transfers control of the dialogues to the students and becomes a supportive observer.
8. During the dialogues, instruction is provided on why, where, and when these strategies might be applied (Rosenshine and Meister, 1994, p. 491).

Forms of Reciprocal Teaching

In a meta-analysis of 16 studies utilizing RT methodologies, Rosenshine and Meister (1994) identified two forms of RT that have evolved from the works of Palincsar and Brown (1984), (i) reciprocal teaching only (RTO), and (ii) explicit teaching before reciprocal teaching (ET-RT). In RTO, exemplified in the initial work of Palincsar and Brown, all explicit modeling, instruction, and procedural prompts, cues and feedback on how to develop and apply the four cognitive strategies take place *during* the instructional dialogues. Thus the students were learning about the strategies and practicing them simultaneously.

In the second instructional form (i.e. ET-RT), the students are first introduced to the four strategies during traditional lessons conducted *before* the RT dialogue began. They subsequently had sessions that allowed them to practice and apply the strategies to expository text comprehension. Rosenshine and Meister (1993) stated that "The purpose of this explicit instruction before RT was to introduce students to the strategies and accompanying vocabulary, not to ensure mastery of the four strategies" (p. 5). Unlike the RTO approach which gradually transfers the learning responsibility to the students, making it a *student*-centered approach, the ET-RT approach is a *teacher*-centered approach, in which the teacher provides the students with prompts, suggestions, hints, explanations, feedback, and corrections.

Both Hashey and Connors (2003) and Lesgold and Welch-Ross (editors, 2012) assert that strategy instruction is more effective if students are taught all the pre-skills and knowledge they will need to use the strategies effectively individually, and that they demonstrate mastery of each skill before proceeding to the next one. Thompson et al. (2000) also recommend the use of familiar texts, as together, these allow the students to focus on mastery of the strategy rather than learning the strategy *and* new content together. The greatest benefits occur when students learn to flexibly use and coordinate multiple comprehension strategies. This researcher is of the opinion that the ET-RT camp is most closely aligned to the experiences and needs of the participants involved in this study (i.e. tertiary-level students), and will utilize this preferred approach.

There is also a third, overlapping instructional approach to teaching cognitive strategies that Rosenshine and Meister (1994) referred to, which they call the *general cognitive strategy instruction*. In this approach, the four cognitive strategies are first taught explicitly by the teacher, who guides the students as they practice applying the strategies, gradually withdrawing

any support as the students become more competent. This instructional approach uses modeling, guided practice, checklists, and thinking-aloud to scaffold the students. However, there is no RT dialogue or cooperative learning (Rosenshine and Meister, 1993).

Information, Instruction and Motivation

Palincsar and Brown (1984) provided information, instruction and motivation to their participants not only with regards to the RT methodology, but also about when and why the strategies should be used. They stated that:

> Throughout the interventions, the students were explicitly told that these activities were general strategies to help them understand better as they read, and that they should try to do something like this when they read silently. It was pointed out that being able to say in your own words what one has just read, and being able to guess what the questions will be on a test, are sure ways of testing oneself to see if one has understood (p. 131).

Reported Results of Reciprocal Teaching

The results of available RT studies are generally favorable towards improved reading-comprehension. In their seminal study, Palincsar and Brown (1984) reported that for their first experiment in which they were the investigating researchers, there were three main findings, (i) the experimental-group students' comprehension scores improved over their control-group counterparts, (ii) there was evidence of the transfer to new tasks of their recently acquired comprehension skills by the students, and (iii) there was a reliable improvement in the student's ability to summarize and predict questions relating to the text segments. Previously the authors had noted that the students were not called upon to demonstrate their clarifying and predicting abilities regularly, attributing this in part to the quality and suitability of the selected texts.

In their second experiment, Palincsar and Brown (1984) introduced the strategy into the classroom using trained volunteer teachers to conduct the interventions in authentic situations, and noted that "The practical significance of any intervention is dramatically improved if it can be implemented under conditions approaching those of the normal classroom" (p. 157). Palincsar and Brown found a similar improvement in the quality of the dialogue as in the previous, pilot study, but it was less dramatic. The authors concluded that despite the teachers' receiving only a limited introduction to the method of RT, they were as effective as the original principal investigators, and the results of the study were "… reliable, durable, and transferred to other tasks" (p. 166). Furthermore, the teachers reported that they would continue using the strategy in their reading classes, and that they were very pleased with the improvements in the students' thinking skills, and their ability to locate important information and organize their ideas. The students also reported favorably to using the strategies in their content classes, and demonstrated a general acceptance of the reciprocal teaching methodology. In a study conducted by AL-Hilwani et al. (1993), the students are described as being intrinsically motivated and actively engaged in the process, a desirable outcome of any teaching methodology.

Reciprocal Teaching Meta-Analyses

Both meta-analyses conducted on RT by Rosenshine and Meister (1993, 1994), used criteria intended to allow for a direct comparison between the studies. The analyses included only studies that (i) explicitly used the words *reciprocal teaching*, (ii) referenced the work of

Palincsar and Brown (1984), and (iii) contained both experimental and control groups in which the authors randomly assigned students to the two groups or determined the two groups to be similar on initial measures of reading-comprehension (Rosenshine and Meister, 1994).

In their 1993 report, Rosenshine and Meister analyzed 19 studies with respect to (a) their instructional types (i.e. RTO or ET-RT), (b) the types of students included in the study (i.e. "All" or studies that used all students in a class, "Good/Poor," studies that used "good" decoders but "poor" comprehenders, and "Below Average," students who were reading at least one year below their grade level, and (c) the types of outcome measures used (i.e. experimenter-developed instruments, standardized instruments, or both). This analysis found no significant differences between the studies with respect to (a) grade level, (b) number of intervention sessions held, (c) group size, (d) number of strategies introduced, and (e) the individual providing the intervention (i.e. researcher or classroom teacher).

The 1994 Rosenshine and Meister report is based on 16 studies, and found a difference in outcome measures when experimenter-developed comprehension tests were used in comparison with standardized tests, in favor of the experimenter-developed measures. The median effect size was .88 for the experimenter-developed tests, and .32 for the standardized tests, indicating that the students performed better on non-standardized tests.

Additional comparisons of the 16 studies analyzed according to the (i) grade level, (ii) number of sessions, (iii) size of the instructional group, (iv) number of cognitive strategies used, and (v) whether the investigator(s) or the teacher(s) did the training were made. The analysts found no difference between the experimental and control groups when comparing studies that had significant outcome results with studies that had no significant outcome results. Also, reciprocal teaching appeared to improve reading-comprehension scores in all grades above the grade 3 level up to the adult level. At the grade 3 level the results proved to be inconclusive.

Furthermore, the number of training sessions held did not impact on the results, despite ranging from 6-100 sessions. Also, the sizes of the experimental (i.e. Treatment) groups varied from 2-23, without any significant size preference being indicated. Palincsar and Brown (1984) used four cognitive strategies in their studies, while other researchers used 2, 3, or 10. However, no significant relationship was found between the number of strategies taught and student's achievements (Rosenshine and Meister, 1994). Neither was there any difference between the two instructional approaches (i.e. RTO and ET-RT), as assessed by either experimenter-developed comprehension tests or standardized tests, or between the groups based on the persons who performed the RT instruction (Rosenshine and Meister, 1994).

Rosenshine and Meister (1994) report that only Palincsar and Brown (1984) attempted to assess their students based on the improvement of the quality of their questions and summaries. Palincsar and Brown concluded that the experimental and control groups were equal in their ability to generate questions. In general, the experimental groups excelled over the control groups in their abilities to write summaries, make predictions, and in their general comprehension scores. Rosenshine and Meister "… interpret this result as suggesting that the students in the experimental group learned some additional processing procedures that were not assessed by simply asking students to generate questions" (p. 504). However, there was no

relationship between their ability to generate questions and their reading-comprehension outcome scores, as measured by either the standardized or the teacher-developed instruments.

McAllum (2014) reports that Hattie (2009) conducted a meta-analysis of 38 international studies and ranked reciprocal teaching as the third highest-impact strategy out of 49 teaching strategies. Hattie also reported improved summarizing and questioning skills by the students, gains on criterion and standardized tests of comprehension, and that new learning was being transferred to novel tasks requiring summarizing, questioning and clarifying skills.

Experimenter-Developed Instruments versus Standardized Instruments

One consistent result reported in both meta-analyses (Rosenshine and Meister, 1993, and 1994) is the higher scores obtained on experimenter-developed comprehension assessment instruments over standardized instruments. Rosenshine and Meister (1994) attribute this observation to several possibilities, among them (i) experimenter-developed assessment instruments are longer, and were therefore 'easier,' providing more contextual clues to the readers, (ii) they began with topic-sentences, a more reader-friendly format, (iii) they were easier to read, requiring less background knowledge, and (iv) the passages used in tests were similar to those used for practice in RT sessions. In contrast, the passages used for standardized assessments were found to be (i) more complex, often requiring several readings of the passages, (ii) required more searching for clues, (iii) the inferential questions asked required greater conceptual knowledge of the content, and (iv) the complex vocabulary used was taken from a wider variety of sources and topics (p. 509). These differences could account for this consistent result in favor of the higher experimenter-developed assessment instrument scores.

Additional studies that employed the RT methodology have also reported favorably the outcomes of improved reading-comprehension and comprehension-fostering and comprehension-monitoring skills. However, it should be noted that it is extremely difficult to assess the quality of RT dialogue, because Palincsar and Brown did not provide a list of specific instructional procedures that represented high quality implementation of RT (Rosenshine and Meister, 1994). A.S. Palincsar (personal communication, November 5, 2011) states that by not specifying every procedure to follow, the authors allow the practitioners to implement the procedure in a manner which suits them best. In the absence of specific criteria to judge the quality of the RT procedure, subsequent researchers have had to develop their own evaluation criteria.

Role of Cognitive Strategies

Rosenshine and Meister (1994) sought an explanation for the impact that cognitive strategies had on increasing reading-comprehension. In reference to Palincsar and Brown (1984), Rosenshine and Meister conclude that the "… new strategies enabled and required the students to perform deeper processing of what they read, to engage in making sense of what they read, to be aware of when they did not understand the material, and to engage in additional reading and searching when they encountered comprehension difficulties" (p. 510). Citing Brady (1990, unpublished doctoral dissertation), Rosenshine and Meister state their belief that the use of cognitive strategies cause the students to read for meaning and to seek understanding rather than simply decode the words of a passage. This represents a change in their attitudes about reading to learn and comprehension. In their 1993 study, Rosenshine and Meister cite Brady (1990) as being unconvinced of the efficacy of the students' clarification and prediction activities. Rosenshine

and Meister also state that there may be differences between the cognitive strategy that was taught and the strategy that was learned and practiced, and that by practicing the strategies, the learners developed new processing strategies, resulting in improved comprehension-score performances.

In sum, the literature is unclear which cognitive strategies are the most effective ones to use with RT, and how many strategies should be taught. Palincsar and Brown (1984) suggest that question generation and summarization are the two most influential strategies. They believe that asking questions and summarizing serves a unique comprehension-fostering function in that they require the students to search the passage and perform deeper mental processing. They also believe that questioning and summarizing have a comprehension-monitoring function, in that difficulty in performing either task signals to the learner that there are comprehension difficulties. There is scope for further research to be conducted in this regard.

Contributions of Palincsar and Brown

Palincsar and Brown should be credited with making four contributions to the successful teaching of reading-comprehension. Firstly, they introduced the terms *comprehension-fostering* and *comprehension-monitoring*, and demonstrated the effectiveness of teaching them to students. Secondly, they identified the four most important reading comprehension-fostering and comprehension-monitoring strategies from among approximately 150 existing "reading skills" listed in basal reader workbooks. Thirdly, they introduced the practicing of the strategies within the context of reading actual materials rather than worksheets, and the provision of scaffolds to support the students' learning process, while expanding the idea of having the students provide support for one another. Finally, they are commended for their refinement and popularization of the instructional concept of "scaffolding," which contributed to the vocabulary and instructional approaches used to teach difficult-to-learn tasks (Rosenshine and Meister, 1994, pp. 506-7).

Weaknesses of Reciprocal Teaching

Based upon the findings of their meta-analysis, Rosenshine and Meister (1994) have identified what they consider to be three main weaknesses reported in the practice of RT: (i) enough has not be written on the implementation of the strategy, (ii) there is no checklist of criteria available for assessing the quality of RT instruction, and (iii) it is difficult to evaluate the quality of the RT strategy in the absence of critical explicit information about the studies reviewed. Nevertheless, the authors strongly recommend the implementation of this model of cognitive strategy instruction, based on the generally favorable research findings.

Again, it should be noted that the 'weaknesses' identified by Rosenshine and Meister (1994) are *not* deemed to be weaknesses by the developers of the RT strategy, but a unique feature of the strategy, that is, adaptability. Personal communication with Professor Palincsar (November 5, 2011) in direct response to the question posed by the researcher: Since methodology can impact the findings of a study, why did you not specify the specific procedures to be followed for implementing reciprocal teaching? (e.g. minimum number of sessions to be presented). In responding, Palincsar indicated that "…the impact of reciprocal teaching is not only a function of time, but of the quality of the instruction that the teacher provides." Palincsar stated that in their research, they "…tried to specify the principles of instruction as carefully as they could, but its enactment depends too on the skill of the teacher."

Reciprocal Teaching Summary

Most college instructors deliver instruction through the teacher-centered 'lecture' methodology. Students enrolling at tertiary institutions enter with a variety of backgrounds, experiences, and skill-sets. Therefore, faculty must be prepared to implement a variety of teaching-learning strategies to assist all their students to be not only academically successful, but efficiently so (Lightweis, 2013). Reciprocal teaching is one such strategy that is suitable for enhancing reading-comprehension.

Embedded within the student-centered theory of RT are five ideas intended to enhance the comprehension-fostering and comprehension-enhancing abilities of students, namely:

i) its focus on helping students acquire comprehension-fostering strategies instead of simply asking them comprehension questions
ii) the provision of four specific comprehension-fostering strategies instead of the tens of "reading skills" that have appeared in reading workbooks
iii) the provision for practicing the strategies while reading actual (i.e. authentic) texts
iv) the popularization of procedures for scaffolding or supporting students as they develop their strategies
v) the popularization of the idea of students providing support for each other (i.e. social learning) within reading groups (Rosenshine and Meister, 1994, p. 520).

The theoretical basis for RT is consistent with the philosophies and concepts of social development theory (i.e. sociocultural theory), expert scaffolding, the zone of proximal development, and constructivism (i.e. cognitive theory). Interest in RT in the early years capitalized on the great interest at the time on metacognition, self-regulation, and strategy instruction (Palincsar, personal communication, November 5, 2011). The implementation of RT consistently demonstrates results of improved achievement outcome scores for Treatment groups over control groups for a wide range of experimental settings. This, in turn, suggests that a combination of summarizing, questioning, clarifying, and predicting activities are collectively important components of effective reading-comprehension, and that they offer comprehension-fostering and comprehension-monitoring strategies to students, resulting in improved academic achievements.

The Cloze Procedure

Upon entering college, few students routinely undergo diagnostic reading-comprehension assessments. Concerns have been expressed around the world, and most pertinent to this study, in Jamaica, where colleges do not offer diagnostic assessments or direct remedial assistance to students in need of such services. Katz and Mullen (1981), lamenting the decline in college students' reading-comprehension scores in the USA, sought to determine the abilities of students (albeit at the college level) to comprehend textbooks assigned to them by replicating and measuring the outcomes, validity, and reliability of readability studies conducted with pre-college and college students, utilizing the cloze procedure.

Originally designed as a measure of the readability of texts for native English language speakers, the cloze procedure was developed by Wilson Taylor in 1953. It was billed as a new psychological tool for measuring the effectiveness of communication (i.e. reading-

comprehension), or text readability (Taylor, 1953). The title "cloze" is derived from a term used in Gestalt psychology that is applied to the human tendency to complete incomplete patterns by mentally providing information to 'close the gaps.' The cloze procedure allows an instructor to utilize passages taken from any current textbook to determine either the readability of the textbook, or the comprehension levels of the students using the text. A typical passage is selected, and words are deleted in a systematic manner, until approximately 50 words have been removed, and are replaced with blanks. The students are then required to read and replace the "mutilated" words, using their background experiences and contextual clues provided within the passage. Correctly replaced words are scored one "cloze unit" (Taylor, 1953, p. 416), and the student is given a percentage score which can be correlated to other standardized achievement scores. Thus, in the cloze procedure, to score a cloze unit one must correctly reproduce a part of a deleted message using context clues to determine what (in the readers' opinion) the missing component should be.

The simplicity of the entire task is described by Taylor as being "clerical," and quick, features which make the cloze procedure quite desirable to educators and researchers. The significance of Taylor's work is connected to the fact that he successfully demonstrated that the cloze procedure produced comparable results to standardized readability test scores, such as those determined by means of the Flesch and Dale-Chall tests. However, the design, administration, and scoring of a cloze test is comparatively straightforward and much easier than that of standardized testing instruments (Taylor, 1953).

Cloze Around the World

The cloze procedure has been employed around the world in both English-speaking and countries speaking English as a second language (e.g., Bertram, 2006, South Africa; Kobayashi, 2002, Japan; Brown, 1983, Canada; Jones, 1997, Wales). A few studies have investigated the use of the cloze procedure with native speakers of English when conducted in non-English languages such as German, Japanese, Russian, and Spanish (Briere, Clausing, Senko and Purcell, 1978). Internet search engines may be biased against non-English language hits. However, a search of the EBSCOhost search engine, using PsycINFO, PsycARTICLES and ERIC databases, with "cloze," "not English," and "not USA" yielded 1,622 hits, several of which were reported in foreign languages, suggesting the universality of the procedure, and thereby its suitability for use within the Jamaican educational system where English is the official spoken language.

Cloze in College

Rosenshine and Meister (1993 and 1994) also propose that cloze tests have been used around the world, and in every level of the educational system, with typically significant success rates. Previously Katz and Mullen (1981) determined that the cloze procedure need not be confined to the elementary school level, that it can provide useful information about the reading capabilities of college students enrolled in specific courses, and may even be used to establish what support services these students need. Their study concluded that:

> (1) the cloze test is a valid measure of reading-comprehension at the college level, (2) more than a single passage should be included on a screening instrument because passage difficulty may vary in a single class, (3) altering the format of cloze passages did not alter the stability of test results..., (4) scoring cloze passages including synonyms did not

> increase the construct validity of the test results, (5) there was a significant correlation between cloze test scores and achievement in college, *but it is not strong enough to be used to predict individual student's grades* (*italics supplied*), and (6) mean scores on cloze tests differ significantly in different content areas... (pp. 19-20).

Cranney (1972) investigated forms of the cloze test, including an objectively scored multiple-choice variation, specifically for use at the College level. Other literature describes applications of the cloze test for native English language speakers and for English as a Second language speakers, both as a reading-comprehension diagnostic tool, as a readability indicator, and as a placement tool at the tertiary level.

Cloze Diagnosis and Evaluation Applications

Hansell (1981) distinguished between the use of the terms *diagnosis* as formative or pre-instructional information gathering, and *evaluation* as post-instructional information gathering. The cloze methodology has been used for both applications, with different claims of success. However, the design and scoring of the cloze test is uniquely different for each type of application. Failure to recognize this point could result in invalid or unreliable interpretations of the findings of any such research. For example, Gipe (1991) states: "The standard deletion ratio of one deletion every fifth word suggested for *assessing* comprehension (Bormuth, 1967, 1968; Rankin and Culhane, 1969) is *inappropriate* for *teaching* the use of context clues as an aid for analyzing unknown words because it distracts from the analytical task at hand and asks the child to guess too frequently" (p. 136). Gipe is implying careful consideration to the specific application of the cloze procedure.

Formal or Informal Evaluations

Goodman (1982) contrasts informal evaluations against formal, standardized or criterion-referenced assessment tests, stating that "Informal evaluation is done for a variety of purposes: to plan instruction, to place pupils at instructional levels, to evaluate progress, to see strengths and weaknesses" (p. iv). Johns (1982) contributes that "Informal tests and measures of reading performance vary widely in (a) scope, (b) sophistication, and (c) in validity and reliability, depending on their design and application" (p.1). Thus I kept the purpose of the assessment clearly in focus when selecting an assessment format.

Without a means of assessing students' reading-comprehension capabilities, instructors have no way of determining the match between their students' reading levels and their textbooks, nor the level of students' understanding of their assigned texts. Hansell (1981) declares that informal evaluations, including the cloze procedure, can be used effectively and efficiently by any teacher to obtain this required information, and have it accessible to aid them in the design of remedial instructional strategies if needed.

Distinguishing Features of the Cloze Test

Taylor (1953) emphasized that cloze is (i) not an alternative readability formula, nor is it (ii) another form of a sentence-completion test. Formulae such as the Flesch and Dale-Chall tests indicate reading-comprehension levels by calculating the number of words, the length of these words, and the types of words used in a passage. These formulae are insensitive to the reader's previous knowledge of the topic under discussion. The cloze procedure, however, does not count

these elements, but seems to "… measure whatever effects elements actually may have on readability. And it does so at the same time it is also taking account of the influences of many other factors readability formulas ignore" (Taylor, 1953, p.417). Unlike word completion items, and other forms of recall-type items that are intended to "… test ability to recall information, rather than to recognize it in context" (Bott, 1996, p. 105), cloze tests can be designed to measure reading-comprehension. However, word-completion tests do have a high discriminating value. Students either know the correct answer, or they don't.

Taylor described the process as "… throwing all potential readability influences in a pot, letting them interact, then sampling the result" (Taylor, 1953, p.417). In demonstrating how well the reader understands the meaning of a mutilated version of a passage, the cloze method relates the meaning of the passage to the language pattern of the text. As Taylor explains:

> Different persons may express the same meaning in somewhat differing ways, and the same language patterns may have differing meanings for different people. The cloze procedure takes a measure of the likeness between the patterns a writer has used and the patterns the reader is anticipating while he is reading" (Taylor, 1953, p. 417).

Furthermore, sentence-completion tests are designed to assess a candidate's knowledge of specific and usually unrelated facts. The words to be deleted are typically pre-determined. However, the cloze procedure deals with a contextually interrelated series of blanks, not isolated ones. Also, Taylor's cloze method repeatedly samples the similarities between the language patterns used by the author to express the textual content, and that of the reader, attempting to determine what he or she *thinks* the writer intended. Taylor proceeds to argue that since the cloze procedure tallies "…language-usage correspondence rather than meanings themselves,…" (Taylor, 1953, pp. 417-8), it can be used to measure "communication success" or comprehension, allowing the assessor to compare totally different topics directly. Moreover, for general comprehension assessment, the cloze requires "… an essentially random deletion of words…" (p. 418), which makes the cloze design "purely clerical," simple enough for anyone to construct.

Theoretical Considerations

The cloze procedure requires students to apply their knowledge of the syntax and semantics of the content of a particular passage (Singer and Donlan, 1980), in conjunction with their own background knowledge of related experiences and language manipulation (Jones and Pikulski, 1974). Gillet and Temple (1990) assert that the immediate and accurate recognition of more than 90 percent of the words in any given passage are prerequisites to effective instructional-level reading (p. 237). Gillet and Temple also confer that reading-comprehension is a process in which the reader utilizes a variety of cues to assist in deciphering information about unrecognized words from the surrounding text. Syntax, that is grammar-related cues, "… are a system of ordering and inflecting words within sentences and ordering sentences within utterances" (p.85). Semantic, or meaning-related cues, are used in conjunction with syntax to create the context of the passage. It is this contextual analysis which assists the reader to replace deleted words, and is a measure of the comprehension levels of the readers. Gillet and Temple proceed to describe context as being:

> … important because the meaning of a phrase or sentence is derived not from the meaning of each individual word, but from these meanings combined with word order and the meaning contributed by previous and successive word groups. Each word has a number of *possible* meanings or referents, but precisely *which* meaning is dictated by the context (Gillet and Temple, 1990, p. 238).

Brown (1983) vigorously defends the validity and reliability of the cloze test as a measure of student's reading-comprehension, despite the wide variance in scores obtained from studies that have investigated these aspects of the cloze procedure, describing the cloze results as ranging between a "weak" (19 percent of variance explained) and a "fairly strong" (83 percent of variance explained) "...measure of overall language proficiency, and almost everything in between as well" (p.110). In explaining these discrepancies, Brown concludes:

> It appears then, that the results of studies on the reliability and validity of the cloze procedure have varied greatly over the years. And in all fairness, it should be pointed out that investigators were changing cloze in the following ways within and between studies:

1. seven different scoring methods have been used
2. numerous deletion patterns have been tried
3. blank lengths have been modified
4. passage difficulties have been varied
5. test length has been changed, and
6. a variety of different samples have been used.

These variables have been manipulated, consciously and unconsciously, in search of more effective ways to construct and interpret cloze tests" (Brown, 1983, p. 110). Clearly these manipulations affected their conclusions related to reliability and validity of the instrument.

Total Language Context

Taylor (1953) reports that for nearly 60 years research has been showing that language behavior depends on its "total context." The results indicate that the ability to identify, learn, recognize, remember or produce any language "symbol" (i.e. element or pattern) depends heavily on the variable degrees to which it is associated with everything else by larger and meaningful (i.e. familiar) overall combinations. Language context "…includes everything that tends to motivate, guide, assist or hinder that behavior. It includes verbal factors- grammatical skills and multitudes of symbols- and non-verbal ones such as fears, desires, past experience and intelligence" (p. 418).

Dispositional Mechanisms

Taylor (1953) clearly states that the cloze procedure is influenced by the "learning theory of communication," where "dispositional mechanisms" are related to (i) redundancy, (ii) transitional probabilities in the communication process, and (iii) dispositional language habits.

Redundancy.

In explaining his conceptualization of redundancy, Taylor furnishes an effective example of how redundancy enhances the replacement of deleted words:

> "Man coming" means the same as "A man is coming this way now." The latter, which is more like ordinary English, is redundant; it indicates the singular number of the subject three times (by "a," "man," and "is"), the present tense twice ("is coming" and "now"), and the direction of action twice ("coming" and "this way"). Such repetitions of meaning, such internal ties between words, make it possible to easily replace "is," "this," "way," or "now," should any one of them be missed (Taylor, 1953, p. 418).

Transitional Probabilities.

Recognizing that some words are more likely to appear in certain patterns or sequences (e.g. "Merry Christmas" as opposed to "Merry Birthday"), Taylor (1953) notes that "Some transitions from one word to the next are, therefore, more probable than others" (p. 419). Such transitional words would definitely improve the probability of the reader determining the correct replacement word.

Dispositional Language Habits.

Each individual acquires "habits of expression" which are greatly influenced by ones culture and personal experiences. If this skill-set is similar to that of others with whom they communicate, then language and meaning transmission and reception between both parties is effortlessly facilitated. These "habits of expression" enable an individual to transmit ideas to others with ease, and for that individual to anticipate words, language patterns and symbols read or heard "almost automatically," intuitively completing a phrase in his or her own way. When the transmitted information fits the receiver's habits, "he understands with little effort," or readily comprehends it. When the communication habits are unfamiliar, the receiver's comprehension rate is "slower and less sure" (Taylor, 1953, p. 419).

Types of Cloze Tests

There are two forms of the cloze test, (i) random deletion, and (ii) rational deletion. The structure of the test has important implications not only for its design, but its scoring and interpretation too. The cloze procedure is utilized to determine (i) text readability (i.e. text difficulty), and (ii) student reading-comprehension levels (Taylor, 1953). If inappropriately designed or implemented, the cloze procedure could produce results that will not contribute to the progress or meaningful advisement of students. Therefore, one should examine carefully the characteristics of these two forms of the cloze procedure.

Random Deletion Cloze Tests

Both types of the cloze test aim to accomplish similar objectives. However, researcher preferences may advocate one form over the other. Random deletion cloze tests are the original or *conventional* form of the test.

Conventional, Random Deletion Cloze Test.

The subject of extensive research, the conventional, random deletion cloze test is easy to construct, administer, and score, and is probably the most frequently found form of the procedure. It is used when the purpose of an evaluation is to (i) measure readability, (ii) place students in appropriate reading materials, or (iii) assess readers' abilities to cope with the demands of content area texts (Pikulski and Tobin, 1982, p. 48). The random deletion test is

characterized by the deletion of every fifth word, regardless of the word, although other popular variations do exist, such as the deletion of every seventh, or even every tenth word.

The 'random deletion' or 'every-nth word' method ignores the differences between words, and is desirable when the cloze procedure is used for contrasting readabilities. Taylor (1953) agrees that some words are easier to replace than others, but argues that "… if enough words are struck out at random, the blanks will come to represent proportionally all kinds of words to the extent that they occur" (p. 419). Thus the 'law of averages' will dictate a uniform distribution of mutilated words if a sufficient number of terms are deleted from any given passage. In addition, if an "every-nth" system is employed, with a sufficiently large number of terms being deleted, eventually this system will approach that of a random deletion method. Kobayashi (2002) states that "The deletion of words at regular intervals ostensibly produces a representative sample of the linguistic features of the text, which makes it possible to obtain a valid measure of the test-takers underlying language ability" (p. 1). It should be noted that the first and last sentences of the selected passage are left intact, so as to allow a sufficient number of context clues for the student to fill in all the blanks (Taylor, 1953).

Construction of a Conventional, Random Deletion Cloze Test

The general procedure for constructing a conventional, random deletion cloze test is as follows:

1. Select a passage of between 250 – 300 words long. The passage chosen should be representative of the content of the book. If the book becomes progressively difficult, select the passage from the second quarter of the book
2. Ensure that the passage is not heavily dependent on prior information
3. Keep the first and the last sentences intact
4. Randomly choose one of the first five words in the second sentence, and omit every fifth word, until 50 words have been omitted. Numbers are counted as one word, while hyphenated words are counted as two words
5. Replace each blank with a numbered, uniform line (typically 15 characters in length)
6. Prepare an answer sheet that the students can use to record their responses (Pikulski and Tobin, 1982, p. 48-9).

The rationale for using a passage of length 250 – 300 words is based on experimental evidence (Bormuth, 1975). Bormuth demonstrated that an expected reliability of .85 could be obtained with such a passage. Pikulski and Tobin (1982) argue that a reliability coefficient of less than .90 cannot be interpreted confidently. However, to increase the reliability coefficient to exceed .90 would require increasing the passage length to 500 – 600 words, with 100 deletions. This would likely increase the students' resistance to taking the test. Also, this longer version would not be able to be accommodated on a single-sheet of paper (Pikulski and Tobin, p. 50).

Brown (1983) asserts that cloze assessments are not really easy to develop if they are to be developed well and yield valid and reliable results which can be used to make sound decisions with regards to the students. If the instrument is to be used for norm-referencing, then it is most valid when it is 'fitted' to match a specific sample (i.e. with a mean score of 50 percent, and a large standard deviation). This will require pilot testing several passages, and utilizing or modifying the one with the best 'fit' as the final instrument.

Administration of the Conventional, Random Deletion Cloze Test

Cloze assessments may be delivered individually, or to a group. However, group administration of a cloze test is more 'conventional' and advantageous to an instructor. Pikulski and Tobin (1982) also recommend allowing students unfamiliar with the cloze procedure to practice before being assessed, using an instrument with at least 10 blanks. Students should also be advised to read through the entire passage carefully before attempting to fill in the blanks, and be informed that there is only one word missing from each blank. Pikulski and Tobin advocate that a separate answer sheet be provided with numbered blanks corresponding to the deleted words from the passage, on which the students can write their responses. This will allow the instrument to be re-used. In addition, although they can be, cloze tests are not typically timed, due to the unavailability or restriction of administration time (Taylor, 1953, p.426). Katz and Mullen (1981) assumed a reading rate of 250 words per minute in their study with college students. They administered five passages of 250 words plus the first and last intact sentences in a 40 minute period to a pilot group. However, this number was reduced to three passages in 40 minutes for the actual group assessment, to accommodate a less than expected reading rate, and which also required the students time for filling in the cloze blanks on the answer sheet.

Scoring the Conventional, Random Deletion Cloze Test.

With a total of 50 deleted words, each correct response contributes two percentage points towards the individual's total score. Pikulski and Tobin (1982) advocate that credit be given only for "exact" or "verbatim" answers to replaced words, and that the teacher may accept spelling errors when it is obvious as to the intent of the response. However, no credit is awarded for "…synonyms or other types of substitutions (girls for girl, walk for walked) even though they may seem somewhat acceptable" (p.51). This recommendation, according to Pikulski and Tobin, is also "…based on a considerable amount of experimental evidence as well as practical considerations" (p. 51).

The acceptance of synonyms for credit results in higher test scores overall. However, the reliability of the test is reduced, due to the subjective nature of what is, and is not an acceptable synonym. Several researchers, for example Katz and Mullen (1981), and Miller and Coleman (1967), have determined that exact scores and scores that accept synonyms are highly correlated. Pikulski and Tobin (1982) found this correlation to be in excess of .95, or 95 percent. Hence, "Unless one has a particular reason for being interested in synonyms, therefore, he might as well use the simpler traditional system that ignores all insertions other than exact words" (Miller and Coleman, 1967, p. 852).

An additional advantage of not using synonyms when scoring a cloze test is that inter-rater or coder reliability issues are avoided, which serve to increase the overall reliability of the obtained scores (Taylor, 1953). Furthermore, Pikulski and Tobin (1982) argue that higher raw scores obtained by accepting the use of synonyms require the teacher to utilize higher criterion scores for student proficiency. In other words, there is no advantage to the student in accepting synonyms when administering a conventional, random deletion cloze test, specifically for the purpose of measuring text readability, placing students in appropriate reading materials, or assessing readers' ability levels with content area texts. For the teacher, it is simply not worth the additional effort.

Interpretation of the Conventional, Random Deletion Cloze Test Scores.

Conventional cloze tests are designed, administered, and scored according to Taylor's original 1953 recommendations. Taylor's design should not be confused with "other recommendations," suitable for "other" applications. The test design of random deletions or every nth word (typically every fifth word, but additional variations such as every seventh, or every tenth word have been tried), with 10-20 percent of the words in a passage being deleted, and with a minimum of 16 blanks per passage, appears to correlate reliably well against other acceptable readability formulae (Taylor, 1953, p. 424). This is a critical requirement in order to accept that the cloze method and the applicable formulae are measuring the same construct, reading-comprehension (see Wagner, 1986). Restated in his words, Taylor utilizes the term "readability" to imply a "…measure of comprehension…" (p. 432). Additionally, Taylor goes on to state "Tentative results indicate that cloze scores correlate highly with the scores of tests designed to measure comprehension and general intelligence," and that "…a cloze score appears to be a measure of the aggregate influences of *all factors* which interact to affect the degree of correspondence between the language patterns of transmitter and receiver. As such, its potential usefulness is by no means confined either to readability or to the reading abilities of individuals" (p. 432).

When Taylor (1953) developed the cloze procedure, it was used as a measure of determining 'readability levels' or the reading ease of textual content. He compared the scores obtained using cloze methodology over a variety of cloze-test formats, with scores obtained using the Flesch and the Dale-Chall standard reading formulae, and found that these scores were highly significantly correlated. Thus, the cloze test could be used to determine the readability of textbooks used by students. The categories used to classify the degree of difficulty of reading materials are (a) frustration level, (b) instructional level, and (c) independent level (Gillett and Temple, 1990, pp. 134-6). The ranges of cloze test scores used to categorize the participants in this study are consistent with the recommendations made by Bormuth (1968) and Rankin and Culhane (1969), and are indicated below.

Frustration Level

If a textbook or passage is at a students' frustration level, that student cannot understand it, even with external support. Materials that are too difficult for students to comprehend cause them to misunderstand and forget the content, and become 'frustrated.' This may be due to the vocabulary employed and or the concepts presented, which often require excessive word analysis, resulting in a slow reading rate, and very poor reading-comprehension levels. Textbooks should not be assigned from this reading level. The predetermined cloze percentage scores for participants believed to be at the frustration level ranges between 0% - 38%.

Instructional Level

Although the reader finds this material challenging at this level, he or she is able to comfortably read content taken from the instructional level, and is able to understand the text with external support. Texts taken from this level are inappropriate for individual work, but the teacher is able to get the most from the students under supervision. The predetermined cloze percentage scores for participants deemed to be at the instructional level is 39% - 49%.

Independent Level

Readers functioning at the independent level are able to absorb information quickly, and with a high degree of comprehension without any external assistance. They can independently complete reading and homework assignments without too much difficulty. Textbooks should be selected from this reading level in order to allow the students to work individually while acquiring information or enrichment content.

Contrary to popular belief, Gillett and Temple (1990) argue that most individuals have not one but a combination of the three reading-difficulty levels, where each level is appropriate for reading different kinds of content, and for different purposes. The cloze procedure may therefore be effectively used to evaluate reading materials, aid in the selection of textbooks, and as a measure of reading-comprehension.

Bormuth (1967 and 1968) and Rankin and Culhane (1969), among others, conducted a series of investigations which matched students' cloze scores with their comprehension scores obtained on multiple-choice tests based on the same content. Bormuth (1967) reasoned that "… multiple-choice comprehension tests have been used for many years and have a widely known frame of reference accepted in both readability research and in classroom practice" (p. 292). Bormuth established that there is a strong correlation between the cloze scores and other comprehension test scores obtained. This gave rise to the use of cloze scores to predict students' reading-comprehension levels (Katz and Mullen, 1981).

In 1969 Rankin and Culhane replicated Bormuth's 1967 study. They too used the 75 percent and 90 percent cut-off points for comprehension criterion scores employed by Bormuth (1967 and 1968) in his studies, and obtained corresponding cloze-scores of 41 percent and 61 percent respectively. Rankin and Culhane (1969) suggest that their 1969 investigation is "… probably more valid than the results of Bormuth's 1967 study" (p. 197). The replication of Bormuth's studies made it possible for teachers to interpret cloze test results with some degree of confidence by using specific percentage scores as criteria of acceptable reading-comprehension performance (Rankin and Culhane, 1969). The predetermined cloze score range used for participants at the independent level is $n \geq 50\%$.

Rational Deletion Cloze Test

The rational deletion cloze test is a modification of the conventional cloze test, which (i) mutilates selected words rather than following a formula to delete every nth word from a passage, and (ii) accepts synonyms as being correct responses to deleted words. Claiming this approach to be a better assessment of one's reading-comprehension, proponents of the rational deletion test believe that the removal of key words provides the researcher with more precise, valid and reliable results, which can improve the precision to which the results may be applied. However, their research has not demonstrated this validity and reliability.

Several researchers advocate for the use of a rational rather than "mechanical" deletion of words from a cloze passage. Commenting on the use of rational cloze assessments, Pikulski and Tobin (1982) state:

> If the exercise is to be used to diagnose the student's strength and/or weaknesses, or to assess how much he/she has learned, the teacher would certainly want to accept synonyms for scoring a rational deletion cloze. Verbatim scoring is necessary only when one wishes to establish functional reading levels, to assess readability, or to evaluate content materials (p. 54).

The two primary functions of the rational deletion cloze test are to (i) gain a clearer perception of the student's ability to use contextual clues as an aid to word recognition, and (ii) assess student mastery of the content of a particular instructional unit (pp. 55-6).

Design of the Rational Deletion Cloze Test.

If the purpose of the cloze test is to assess reading-comprehension, and it is decided to use the rational deletion approach, then the design of a rational deletion cloze test is different from that of the random deletion design. In rational deletion cloze instruments, key words are deleted, regardless of where they are located in the passage, or the type of word. The responsibility of the student is to use contextual clues and background knowledge to replace the key words that have been deleted from the passage.

Administration of the Rational Deletion Cloze Test.

There is no differentiation made between the administration of the rational cloze test and its random test counterpart. The student is, in effect, oblivious to the type of test being used.

Scoring of the Rational Deletion Cloze Test.

The primary concern with scoring rational deletion cloze tests lies with accepting or not the use of synonyms. If the use of synonyms is acceptable to the researcher and the purpose of the test, then the decision must be made as to which synonyms are allowed, and whether full- or partial credit will be awarded for their use. This scoring procedure is similar to that of random deletion cloze tests, but is more challenging. It depends on the objective of the test.

Interpretation of the Rational Deletion Cloze Test Score.

The interpretation of rational deletion cloze test scores is conducted in much the same way as for random deletion test scores. However, it should be noted that if the use of synonyms is permitted, then the raw scores will be higher than if accurate words only are scored as being correct. This will serve to push up the mean cloze score, and will require a corresponding higher comprehension criterion score to ensure that students are not diagnosed as being above their true reading-comprehension levels.

Criterion-Referenced vs. Norm-Referenced Cloze Tests

Taylor (1953) describes the cloze procedure as being "very sample sensitive," to the extent that readability grade-levels could be established by using it. Whereas readability formulae are insensitive to a particular population's previous knowledge of the topic being discussed, and are suitable for criterion-referencing, cloze scores may be either criterion-referenced or norm-referenced. The application depends on (i) the design, and (ii) the scoring of the test. Brown (1983) argues that the wide disparity between the samples used in cloze experiments may have much to do with the observed variability of the cloze results. This conclusion suggests that the

cloze procedure is more appropriate for *norm*-referenced applications of *reading-comprehension*. However, the cloze procedure may be reliably used for *criterion*-referenced *readability* applications if it is appropriately designed and scored for this purpose.

Bott (1996) describes criterion-referenced tests as ones which "… make an interpretation of the score with respect to some standard or criterion…," and that such tests "… will determine when the students have reached the accepted level of performance." Bott goes on to say that "… passing criteria are based on specific requirements… not on the judgment of the teacher." Contrasting criterion-referenced tests with norm-referenced tests, Bott says that the latter is designed to "… determine individual students' positions within a normative group …," and that "Norm-referenced examinations act as sorter devices- they sort students or test takers into various levels" (pp. 5-7).

Informal Assessment using Cloze Procedure

Pikulski and Tobin (1982) postulate that the cloze procedure possesses four opportune features that are closely associated with informal reading assessment tools. It: (i) can be teacher constructed rather than in a published form, (ii) can be constructed from materials that might be used for instructional purposes, (iii) uses pre-established criteria to assess individual performance rather than normative standards, and (iv) can provide helpful information about the most effective instructional levels for the students (p. 42).

Synonyms and Scoring Cloze Tests

Kobayashi (2002) introduced a subtle but significant consideration with regards to accepting or rejecting synonyms when scoring the cloze test. Kobayashi's study found that test performance varies greatly, depending on the scoring methods used. Kobayashi argues that the cloze test is more effective in discriminating between 'more' and 'less' able learners when the semantically only acceptable-word scoring method is employed. However, Kobayashi contends that "If it is the learners' comprehension that is in focus, it seems justifiable to accept answers that are syntactically incorrect, but make sense in a given context" (p. 579). Kobayashi goes on to say that cloze items vary in their difficulty and discrimination, and that different starting points for deletion, and different deletion rates might contribute to significant variations in the nature of cloze items taken from the same passage. Since there is no established guideline for accepting synonyms for either full-, or partial credit, the scoring of synonyms is a subjective exercise if synonyms are accepted, which could readily influence the outcome of any given study. If synonyms are not accepted, then college students, as well as the more competent readers who are better able to think of suitable synonyms in lieu of deleted words are the ones who will be penalized for their thoughtfulness (Katz and Mullen (1981), Kobayashi (2002)).

Comparing Cloze and Multiple-Choice Comprehension Test Scores

Bormuth (1967) conducted an interesting study that related scores obtained on a multiple-choice test to scores obtained on a cloze test of material taken from the same content. The results suggested that a score of 75 percent on a multiple-choice test of reading-comprehension is equivalent to a score of 38 percent on the corresponding cloze test, and a score of 90 percent on a multiple-choice test is equivalent to 50 percent on a cloze test. Bormuth therefore determined that students who scored less than 38 percent on a cloze test were reading at the frustration level. Students who scored between 39-49 percent on a cloze test were reading at the instruction level,

and students who scored above 50 percent on the cloze test were reading at the independent level. If the multiple-choice score is corrected for guessing (it was assumed that because there were four alternatives for each item, the subjects guessed correctly on one-fourth of the items for which they did not know the correct answer (p. 295)), then a raw score of 75 percent would correspond to a cloze score of 44 percent, and a raw score of 90 percent is equal to a cloze score of 57 percent. Thus, by means of a simple conversion, an assessor can convert a cloze score into a 'reading-comprehension score' to determine the extent to which students understand what they are reading.

In 1968 Bormuth repeated his study, with similar results. However, the cloze percentage scores were slightly higher than those of his 1967 study. This adjustment is acceptable if one considers the subtle nature of the cloze test, and the fact that Bormuth used a different population, different passages, etc.

Rankin and Culhane (1969) replicated Bormuth's two studies, and obtained results comparable with the 1968 study. Using the 75 and 90 percent comprehension scores as a "…conventional criteria for evaluating reading-comprehension…" (p. 197), Rankin and Culhane obtained cloze scores of 41 and 61 percent respectively as being their equivalents. These cloze scores compared fairly well with Bormuth's 1968 cloze percentage scores of 44 and 57 percent respectively. Rankin and Culhane assert that Bormuth maintained that his 1968 results are more valid than those of the 1967 study (p. 197).

The significance of these and other similar studies relating cloze testing with other forms of comprehension assessments is that they give greater degrees of confidence to classroom instructors as to the reliability and validity of employing a cloze assessment to measure the specific reading-comprehension levels of their students utilizing their content text materials. Considering the ease at which cloze instruments may be created, and comparing it with the degree of difficulty involved with the creation of multiple-choice instruments to determine the same construct of reading-comprehension, the benefits of utilizing the cloze procedure are self-apparent.

Advantages of the Cloze Procedure

While acknowledging that "…there are still many unanswered questions about how effective the procedure is as a *diagnostic* tool and the form that cloze procedures should take" (p. 43, *italics supplied*), Pikulski and Tobin (1982) propose that it is advantageous to employ the cloze procedure as an informal *evaluation* tool. Furthermore, when administered to a large group of students, the cloze test is a quick and efficient tool whose results can be interpreted in a fairly straightforward fashion. Bertram (2006) reports that "… the cloze procedure tests how well a student can use the context clues of a text to predict what word the author used in a particular gap," and that it "… tests whether a reader has understood the literal and possibly the inferred meaning of the text…" (p. 7). Citing a reference by Rye (1982), Bertram (p. 7) concurs that "… various studies have shown that the scores achieved on a cloze procedure have a high correlation with scores achieved on other reading tests on the same passage." Bertram goes on to say that it is generally accepted that a cloze score is a reliable measure of the general comprehension of a particular text. Thus, the teacher can quickly and economically construct an effective instrument to determine several desirable characteristics of readers, and may administer, score and interpret

the results of this test with a fair degree of confidence in the validity and reliability of the test without advanced training in psychometrics.

Disadvantages of the Cloze Procedure

The cloze procedure, being imperfect, has limitations and disadvantages. Babcock (1975) points out that "… failure to predict accurately a given word may influence subsequent responses" (p. 2). Meanwhile, Rankin and Culhane (1969) assert that a higher cloze score implies that one is a relatively 'better' reader. However, raw scores do not tell us how well the reader comprehends the material. For this interpretation, we need a frame of reference to which we may compare the score with respect to a standardized score.

Gipe (1991) identifies the fact that the effectiveness of the cloze test as an assessment instrument "…is not clearly established" (p. 90) as the procedures' major disadvantage. Gipe proceeds to state that in order "…for teachers to observe the reading process in action they must still listen to children read" (p. 90). However, Gipe endorses the usefulness of the procedure to "… potentially provide helpful information regarding a reader's use of syntactic and semantic cues" (p. 90).

Another major disadvantage of the use of the cloze procedure lies with its favored group administration. Pikulski and Tobin (1982) argue that group administration "…sacrifices the ability to make detailed diagnostic observations and it lacks precision of results that can be achieved through individually administered instruments" (p.43). Pikulski and Tobin also state that when used as a screening device, that its results should "…be viewed as tentative" (p.43). In addition, Bertram (2006) notes another limitation of the cloze test is that it "… cannot measure whether the reader is able to make a critical evaluation of the text" (p. 7). Collectively, these concerns should cause any researcher to exercise caution and concern when deciding to use and interpret the results of a cloze assessment. However, the cloze assessment instrument remains a valid and reliable tool to be used in the determination of reading-comprehension levels, and is used as the major quantitative data collection component of this study.

Cloze Procedure Summary

The cloze procedure provides a simple, quick, and efficient way for classroom teachers to determine their students' reading-comprehension levels, and the readability of their textbooks. Variations of the procedure have resulted in apparently conflicting claims and counter-claims. In the absence of valid and reliable alternative assessment instruments for the Jamaican context, this study, based on the literature reviewed, will utilize the conventional random deletion cloze design for its pre- and post-test instruments. This design, as originally proposed by Taylor in 1953, satisfies the requirements of an objective, unbiased, and culture-free measure that can indicate the existence of a reading-comprehension problem, as well as provide quantitative indications of student pre- and post-intervention achievements, two important considerations in the design and execution of this study.

Chapter Summary

In this chapter, the researcher has reviewed literature related to the purposes of this study. It outlines significant differences between academic research and evaluation studies, and then focuses on four cardinal concepts to justify the research methodology applied, as determined by the 1994 Evaluation Standards. The literature reports on the importance of metacognition as a

conscious, self-regulatory activity to be desired in all learners, which can increase their academic achievement. Reciprocal teaching is presented as a specific strategy designed to enhance and foster the reading-comprehension of students, by making them metacognitively aware, and affording them opportunities to practice and reinforce their skills in a collaborative manner. Meanwhile, the cloze procedure has been presented as an assessment instrument that is simple to develop, administer and score, while yielding reliable indicators of the student's reading-comprehension levels.

The theoretical bases of metacognition, reciprocal teaching, and the cloze procedure are the foundation and rationale for the execution of this quasi-experimental study. It is anticipated that the results of this research will add to the existing body of knowledge on the impact of reciprocal teaching on reading-comprehension. By providing insights into the Jamaican educational system (see Chapter One), and one of its major problems to academic achievement being experienced, an applicable solution, as it relates to reading-comprehension among first-year students in the Industrial Technology teacher-education major programs at UTech, can be evaluated, and that especially non-Jamaican readers of this study can appreciate its structure and make pertinent comparisons with their own educational systems, and see the relevance of conducting this study.

CHAPTER III
RESEARCH METHODOLOGY

This chapter presents the design considerations, participant descriptions, sampling methodology, and data collection and analyses strategies employed during the completion of the study. The general format of the outlined procedures of this chapter closely follows that suggested by Gall, Gall and Borg (2005), and caters to the requirements and assumptions of both the quantitative and descriptive research data.

Evaluation Standards

True experimental research designs, with their random selection and random assignment of a relatively large sampling of a representative population, permits the legitimate application of parametric statistical analyses of the research data. The underlying premises and logic of true experimental designs *must* be satisfied at all times in order to implement the parametric analytical tools, which permit the researcher to make valid generalizations of any research findings.

Educational research does not always permit the application of parametric analyses (i.e. true-experimental research designs). Hence, quasi-experimental designs (see Cook and Campbell, 1979), with their non-parametric equivalent analyses are frequently utilized in educational research (Bastick and Matalon, 2004; Fraenkel and Wallen, 2000). Citing Cook and Campbell (1979), Gefen and Ridings (2002) state that experimental designs show causation through mathematical association, isolation of extraneous variables, and temporal precedence, while operating in artificial laboratory-like conditions with a sampling of a typical population. Quasi-experimental designs alternatively show "plausible causation" (p. 56) with a representation of the actual population in a real-world setting.

The general research principles incorporated in the Revised Evaluation Standards developed by the Joint Committee on Standards for Educational Evaluation (1994) represents the agreed characteristics of good research practice. As such, these thirty standards, grouped into four categories, namely *utility*, *feasibility*, *propriety and accuracy*, provided the criteria for judging, and by extrapolation, the design and implementation of the study (Gall, Gall and Borg, 2005; Krathwohl, 1991; Patton, 1997), and were used as the basis for determining its educational merit and efficacy.

Research Design

Due to the limited size of the total accessible Industrial Technology teacher-education major population selected for this study ($n_{IT} = 42$), it was not feasible to employ a randomized, true-experimental research design. The related research methodology literature reviewed suggested to the researcher that a quasi-experimental research design was the most suitable alternative for the intent and purpose of this study. For this reason, a Matching-Only Pre-test – Post-test Control Group Design (Fraenkel and Wallen (2000), and Johnson and Christensen (2003)) was employed, along with the use of a pre-test only combined non-Industrial Technology ($n_{non\text{-}IT} = 40$) and non-FELS ($n_{non\text{-}FELS} = 51$) Comparison group ($n_{comp} = n_{non\text{-}IT} + n_{non\text{-}FELS} = 91$) to specifically address Research Question 2.

The research design utilized is represented symbolically as:

Treatment Group:	O_1 M X O_2	($n_{Treat} = 19$)
Control Group:	O_1 M O_2	($n_{Cont} = 23$)
Comparison Group:	O_1	($n_{Comp} = 91$)

where O_1 represents the administration of the cloze-type pre-test instrument

M represents the mechanical matching of the participating non-randomly selected Industrial Technology teacher-education majors into an *assigned* group (i.e. Treatment or Control group), based on the cloze-type pre-test raw scores, and subsequently the cooperation of the participants

X represents the administration of the reciprocal teaching intervention

and O_2 represents the administration of the cloze-type post-test instrument, where the pre-test instrument was used as the post-test instrument, that is, $O_1 = O_2$.

The mechanical matching of the estimated 42 volunteer first-year (i.e. freshman) IT participants was determined by comparing and matching similar performances on the researcher-developed cloze-type pre-test raw scores of the participants' initial reading- comprehension levels. One of each matched pair of participants was then randomly assigned by means of a coin-toss, to the Treatment group ($n_{Treat} = 19$). (It should be noted that initially both groups had 24 participants. However, student academic mortality caused the disparity between the final group sizes). The other 'matched' participant was automatically assigned to the Control group ($n_{Cont} = 23$). A purposively selected combined sampling of first-year non-IT teacher-education majors ($n_{non\text{-}IT} = 40$) and non-FELS students ($n_{non\text{-}FELS} = 51$) enrolled in faculties other than the faculty of interest, was used specifically to address Research Question 2, and formed the total Comparison group ($n_{comp} = n_{non\text{-}IT} + n_{non\text{-}FELS} = 91$). Neither the Control nor the Comparison groups received any intervention treatment.

The use of the quasi-experimental design allowed for both quantitative and descriptive data to be collected and analyzed. Quantitative data were obtained from the pre- and post-test cloze instruments, as well as by quantifying the in-class intervention activity scores, which permitted an estimate of the magnitude and degree of significance of any anticipated gain-scores. The descriptive components of the methodology enriched the understanding of the effectiveness of the strategy, especially from the perspective of the participants, and were obtained primarily by means of coding and analyzing the questionnaires and interview schedules.

The addition of a combined Comparison group of FELS non-Industrial Technology teacher-education majors and non-FELS students, along with the FELS Industrial Technology group (i.e. the Treatment and Control groups), as suggested by Fraenkel and Wallen (2000), allowed for distinctions and contrasts to be made between these three groups. Collectively, the data garnered permitted the researcher to address all of the research questions and determine the efficacy of the use of the reciprocal teaching strategy to positively impact the group-mean reading-comprehension scores among the target population.

Research Questions

The threefold aim of this study was to determine empirically: (i) whether the first-year Industrial Technology teacher-education majors at UTech have a reading-comprehension problem, when compared with respect to students enrolled in the other programs and faculties at UTech, (ii) to evaluate the effectiveness of the reciprocal teaching strategy in positively impacting the reading-comprehension scores of these Industrial Technology teacher-education majors at UTech, whether or not there was a real reading-comprehension problem, and iii) to determine the degree of acceptance of the RT strategy by the participants of the study. The general intent of this study was to advise the Faculty administrators on whether or not to implement the reciprocal teaching strategy into the curriculum of the program. To this end, the study sought to investigate and address the following three research questions:

1. Does the reciprocal teaching method improve reading-comprehension among first-year Industrial Technology teacher-education majors at UTech?

2. What reading-comprehension levels are characteristic of first-year Industrial Technology teacher-education majors at UTech?

3. What are UTech Industrial Technology teacher-education majors' perceptions of the strengths, weaknesses, and effectiveness of the Questioning and Summarizing reciprocal teaching intervention sub-strategies?

Research question one was the major focus of the study. It addressed the effectiveness of the reciprocal teaching strategy intervention on the Treatment group participants. Research questions two and three sought to address the affective domain of the participants and their reading-comprehension capabilities. Question two explored the current reading-comprehension levels of the participants, as determined by the researcher-developed cloze test instrument. Question three investigated the Treatment groups' perception of the impacts of the two major components of the reciprocal teaching strategy on their reading-comprehension levels. Together these research questions, along with additional information that was collected helped the researcher to determine profiles of the participants, and specifically the effectiveness of the reciprocal teaching intervention on the Treatment group.

Research Variables

The logic of experimental research entails the manipulation of an independent variable, and the monitoring of the effect(s) caused by this manipulation on a dependent variable. If adequate controls are put in place to minimize the effect(s) of extraneous variables, and there is a discernible statistically significant change in the dependent variable, then it can be reasonably concluded that the manipulation of the independent variable caused the observed difference in the dependent variable (Campbell and Stanley, 1963; Fraenkel and Wallen, 2000; Gall, Gall and Borg, 2005).

For the quasi-experimental methodology employed in this study, the independent variable was the reciprocal teaching methodology that was manipulated between the Treatment and Control groups. The dependent variables for this study were the group-mean and individual reading-comprehension scores as measured by the researcher-developed cloze-type instrument, the four

reciprocal teaching component pre- and post-test mean group scores, along with the entry and exit questionnaires and interview instrument responses.

Validity Issues

All useful research must be both valid and reliable if any level of confidence is to be attributed to its findings. Validity coefficients are reported as values ranging between -1.00 and +1.00, with the negative value indicating an inverse relationship, and the positive value, a direct relationship. A zero value would indicate that there was no relationship between the variables being evaluated (Gall, Gall, and Borg, (2005). For experimental, and by extension quasi-experimental research, the significant primary terminologies relating to instrumentation validity are (a) content, (b) criterion, and (c) construct (Campbell and Stanley, 1963; Fraenkel and Wallen, 2000).

Content Validity.

Content validity relates to the appropriateness, meaning, and usefulness (Bastick and Matalon, 2004) of the content and format of the instrument(s) used, and its adequacy in measuring what it is intended to measure. Content validity evidence can be verified by the use of independent subject matter experts (SME's) to confirm that the objectives of the instrument(s) could be satisfied by the design and administration of the instrument(s) (Bastick and Matalon, 2004).

In this study, I utilized the services of three subject matter experts to assist in the development and vetting of a rubric (see Appendix A) that was used to evaluate and endorse the validity of the assessment instruments. Factors considered included an analysis of the content covered, the instructions, font-size and printing, readability, and scoring procedures, all within the context and objectives of the study. All three SME's agreed that the instrument design as proposed was "content valid."

Criterion Validity.

Criterion validity evidence is a measure of how well the instrumentation compares when measuring variables against other proven 'valid' measures. There are two forms of criterion validity; (a) Predictive and (b) Concurrent (Bastick and Matalon, 2004; Fraenkel and Wallen, 2000).

Evidence of the predictive validity, or the confidence provided that there is a relationship between an initial score on the dependent variable (i.e. reading-comprehension scores) and its subsequent score, was assessed by using the Spearman's rank-order coefficient (r_s, $p < .05$, or its parametric equivalent, the Pearson's *r*) to compare the cloze pre-test and post-test scores for both the Treatment and the Control groups independently. If the cloze instrument has good *predictive* criterion validity, then the non-parametric pre- and post-treatment correlation should have a strong negative value (i.e. resulting from an improved post-test score) for the Treatment group, and a strong positive value (i.e. no significant change score) for the Control group.

Also, the criterion validity of using the cloze test scores as a measure of reading-comprehension ability is consistent with the seminal works of Taylor (1953), Bormuth (1967, 1968), Rankin and Culhane (1969), and Katz and Mullen (1981), who collectively demonstrated that the cloze test instrument was able to indicate the reading-comprehension levels of students, including tertiary

students. These pioneers established that the use of cloze instruments yielded comparable reading-comprehension results to those of the Flesch, Flesch-Kincaid, and Dale-Chall readability tests (see Chapter 2), and therefore possessed a degree of predictive validity.

Furthermore, an expectancy table (Fraenkel and Wallen, 2000) was used to make a comparison between the initial self-reported reading-comprehension assessments and the pre-test cloze scores. The expectancy table categorized the self-reported reading-comprehension percentage scores of the participants with their performance on the cloze pre-test, and was a measure of the evidence of the *concurrent* validity of the instrument. Analysis of the data thus obtained was used to address Research Question 2.

Construct Validity.

Construct validity relates the characteristics of the psychological construct in measuring the dependent variable (i.e. reading-comprehension). To evaluate the construct validity evidence of the instrumentation used, the dependent variable was defined, and alternative and null hypotheses were formulated. The alternative hypothesis (H_1) stated that the reciprocal teaching intervention would result in statistically and practically significant cloze post-test - pre-test gain-scores for the Treatment group. The null hypothesis (H_o) stated that there would be no statistically significant cloze-test gain-scores for the Control group who did not receive the reciprocal teaching intervention. The null hypothesis (H_o) was then tested empirically and logically by means of the Spearman's rank-order (r_s) correlation test (or its parametric Pearson's *r* equivalent). It should be noted that all statistical analyses were reported at the $p < .05$ significance level.

Control of Extraneous Variable.

Extraneous variables provide alternative explanations for observed changes in the dependent variable, thereby reducing the certainty at which the changes in the dependent variable are attributable to the independent variable. There are several strategies that a researcher can employ to control for extraneous variables. The primary strategy used in this study was the application of the *mechanical matching* of the participants into the Treatment (those who received the intervention) and Control (those who did not receive any intervention) groups, based on their pre-test scores (Fraenkel and Wallen, 2000). Both the Treatment and the Control groups were expected to experience similar extraneous influences during the course of the study, and could therefore be contrasted directly. Mechanical matching does not eliminate the implications of extraneous variables. However, matching does reduce the adverse impact that such extraneous variables might have on the outcome of the study. It enhanced the *extrapolating* capability of the study, or the ability to generalize not to the wider general population, as in the case of a true-experimental design, but to a more targeted population that shares similar but not necessarily identical relevant population characteristics and conditions with the participants of the study (Patton, 1997).

Mechanical matching, as opposed to *statistical* matching, entails noting the characteristics of the participants, and then pre-testing them, after which they were each paired with another participant who scored a similar score, and who shared other similar characteristics. By means of a random-type *assignment* strategy, one member of each mechanically matched pair was assigned to the Treatment group, and the other automatically assigned to the Control group. It

should be noted that this was not a 'pure' randomization practice, as not every participant had an equal chance to become a member of the Treatment group (Fraenkel and Wallen, 2000).

Threats to Internal Validity

The experimental research design is very effective for showing cause-and-effect relationships (Campbell and Stanley, 1963; Leedy and Ormrod, 2001). However, every research design has some measure of weakness. In order to have confidence in the findings of a study, the extraneous variables with their alternative explanations have to be eliminated, or at worst, controlled. That is, the threats to the internal validity of the study needed to be identified and removed or controlled. If this stipulation is not satisfied, there would be serious limitations to the generalizations of the findings to a wider, different population.

Campbell and Stanley (1963) identified eight common threats to the internal validity of experimental research designs. In particular, Fraenkel and Wallen (2000) identified ten threats to the internal validity of the experimental/quasi-experimental, matching-only pre-post-test control group design used in this study, that subsume those of Campbell and Stanley as follows:

i) Subject characteristics: Subject (i.e. Participant) characteristics include a wide range of physical and psychological factors that can be influenced by the non-random selection of participants who may differ from each other in various unintended ways that are related to the variables being studied (Fraenkel and Wallen, 2000).

   Of particular interest regarding these university students was their reading-comprehension skills. Therefore, the participants were mechanically matched based on their cloze pre-test reading-comprehension scores on a researcher-developed instrument, and *assumed* to be similar in other characteristics over which the researcher had no direct control. Every attempt was made to control this threat to the internal validity of this study. However, due to the wide and varied scope of possible participant selection bias, it is acknowledged that subtle differences in the participant characteristics are still feasible.

ii) Mortality: A mortality threat occurs when participants who started out being a part of the study do not complete the exercise. Mortality may adversely influence the post-test scores of the study if the 'drop outs' possess unique characteristics pertinent to the study (Fraenkel and Wallen, 2000). However, if mortality is truly a random act, then it should affect both the Treatment and Control groups equally. To this end, the participants were made aware of the benefits and the importance of the study, and were provided with a small token for their efforts to keep them interested in the study. Even though the researcher attempted to control this threat, several unforeseen variables could still cause it to occur (Fraenkel and Wallen, 2000). The fact that four participants were unable to regularly attend, and did not complete the study was beyond the control of the researcher.

iii) Location: A participant is liable to perform differently under different test administration circumstances. To reduce the impact of this threat, the data were collected from all the participants at the same time, at the same location, and under the same administrative circumstances (Fraenkel and Wallen, 2000). The effect of this threat was therefore considered to be controlled.

iv) Instrumentation: The ways in which the data collection instruments are used can pose threats to a study. Three threats to the internal validity relating to the research instrumentation are identified (Fraenkel and Wallen, 2000): 1) Instrument decay – this was addressed by using a common pre-test – post-test instrument for both the Treatment and the Control groups, unbeknown to either group. The instrument administered was vetted by the subject matter experts and pilot-tested before it was used in the study. The effect of this threat was controlled. 2) Data collector characteristics – the researcher collected all of the data acquired personally, thereby reducing any potential impact or bias that this threat might impose by using more than one data collector. The effect of this threat was controlled. 3) Data collector bias – the researcher, as the sole collector of data, endeavored to be consistent and bias-free throughout the duration of the study.

Furthermore, the cloze test instrument, the primary data collection instrument, is an untimed, objective-type instrument, with no ambiguity in scoring it. Where subjective data were evaluated, the subject matter experts, who were oblivious as to who the research participants are, conducted the scoring, or verified the results of this exercise. The effect of this threat was therefore controlled.

v) Testing: By using a Treatment and a Control group for the primary component of the study (i.e. the effect of the reciprocal teaching strategy), the impact of testing between the pre- and post-test scores was controlled, since it would be reasonable to assume that both groups would be affected equally by this threat (Fraenkel and Wallen, 2000). The participants, especially the Treatment group members, were consistently encouraged not to discuss or interact with the Control group members with respect to the research variables during the course of the study. Further, the eight-week time interval between the pre- and post-test data collection would not allow the participants to readily recall their exact responses from the initial administration of the cloze test.

vi) History: A history threat occurs when an unanticipated event occurs that can affect the responses of the participants to the data collection instrumentation (Fraenkel and Wallen, 2000). The use of the Treatment and Control groups design does provide a measure of protection against this threat, as it would be reasonable to assume that any widespread, extraneous factors' influence that could impact the reading-comprehension performance of the participants would influence both groups equally. The effect of this threat was assumed to be controlled in this study.

vii) Maturation: Natural or experiential learning and development may account for changes between pre-test and post-test scores, acting independently of the intervention (Fraenkel and Wallen, 2000). Again, by using a Treatment and a Control group design, the impact of maturation between the pre- and post-test scores was controlled for in both the Treatment and the Control groups, since it would be reasonable to assume that both groups would be affected equally by such threats. Also, the research was conducted over a relatively short time frame, spanning 11 weeks. This time period was long enough to prevent the participants from remembering their responses to the pre-test instrument, while being sufficiently short to prevent wide-ranging natural extraneous variables from significantly impacting the study. The effects of this threat were controlled.

viii) Attitudinal effect: Their willingness to participate (i.e. voluntary participation), and their perceptions of the relevance of the participants to a study may influence their performances in the study (e.g. the Hawthorne effect) (Fraenkel and Wallen, 2000). It was likely that this threat could have an impact on the study, and special attention was paid to reduce its potential impact. The Treatment group members were warned not to interact with the Control group members with respect to the study. Furthermore, the Control group members were informed that, upon the completion of the study, the researcher would repeat the reciprocal teaching intervention process with them. It was assumed that this threat was controlled.

ix) Regression: A regression threat may occur when pre-test scores are artificially extreme, that is, very low or very high. Subsequent administrations of the test instrumentation will result in scores moving (i.e. regressing) closer towards the group-mean scores (Fraenkel and Wallen, 2000). The use of one member of each matched-pair, based on the cloze pre-test scores, being randomly assigned to the Treatment group while his/her 'match' (with a similar pre-test score) is placed in the Control group significantly neutralizes the effect of this threat. It was therefore reasonable to assume that both groups would most likely be affected equally, and that this threat was controlled.

x) Implementation: Implementation threats result from biases and human errors being introduced in the delivery of the intervention. This threat is typical to *every* research design methodology unless measures are specifically taken to reduce it (Fraenkel and Wallen, 2000).

The researcher is an experienced teacher with over 20 years of teaching experience at the tertiary level. In addition, the reciprocal teaching methodology was thoroughly researched, and practiced during the piloting-phase of the study, until the researcher was comfortable with the proceedings. This study utilized only one Treatment group, thereby eliminating any preferential delivery bias. Also, the researcher's doctoral committee reviewed the proposal, made recommendations to improve the study, which were implemented, and gave approval for the completion of the data-collection for the study as outlined.

One novel component of the study involved the researcher applying for, and obtaining IRB approval from the VPISU to use 'Skype' technology (a non-recording audio-visual medium) to demonstrate the delivery of the intervention to the subject matter experts (see Appendix E). The value of this activity could never be adequately emphasized, as it allowed the researcher to obtain critical feedback multiple times in the reciprocal teaching strategy implementation, and to acquire confidence and competence in the delivery of the reciprocal teaching intervention.

Thus, although not totally eliminated, the potentially adverse effects of the poor execution of the intervention strategy were reduced significantly. It was assumed that the threats to the internal validity of the study were not sufficiently significant to skew any findings of the research and thereby disqualify or discredit them.

Threats to External Validity

The external validity of a study is a measure of the extent to which the results of the study can be generalized to other similar populations (Fraenkel and Wallen, 2000). Bracht and Glass (1968), and Fraenkel and Wallen label two broad factors that affect the generalization of the results of one study to other individuals or groups across different settings and times as threats to external validity. Of particular interest to this study were the (1) population validity (i.e. relevant participant characteristics), and (2) ecological validity (i.e. impact of differing settings and conditions on data collection).

Population validity is the degree to which a given study can be generalized from a specific 'sample' (i.e. the participants of this study) to a population of future first-year Industrial Technology teacher-education majors (i.e. the target population). Ecological validity is an estimate of the degree that the results of a study may be generalized to a similar locale (e.g. classroom) setting (Fraenkel and Wallen, 2000). Throughout this study, the participants of the Treatment and Control groups were each typical of first-year Industrial Technology teacher-education majors, based on important factors such as age, gender, academic aptitude and community characteristics (i.e. relevant population characteristics). In addition, the research setting was typical of a classroom-type setting, but not one practicing the reciprocal teaching methodology. The objective of this study was to determine the proposed recommendation regarding the implementation of the reciprocal teaching strategy into the classroom delivery practice within the Industrial Technology program, which would require and incorporate the ecological validity of the study in order to be meaningful.

By means of a quasi-experimental research design, this study used the findings of both the quantitative and the descriptive research data to address all of the research questions. To this end, the quality of the study heavily depended of the integrity and expertise of the researcher, who endeavored to make the study appropriate and credible for its intended decision-making purpose (i.e. external validity) based on the empirical evidences obtained.

Descriptive Considerations

Qualitative research portrays a different set of general characteristics from quantitative research, as depicted by Fraenkel and Wallen (2000) and Roblyer (2005). Qualitative research is typically conducted in a near natural setting, relies on self-reporting measures to present the participant's perspective, is equally concerned with the process followed in conjunction with the product derived, tends to be inductive in its approach to data analysis and interpretation, and is quite context sensitive. Furthermore, data are characteristically collected individually, are analyzed individually (Fraenkel and Wallen), and are appropriate for measuring a single case (Roblyer). This study is not a qualitative study, it does, however, collect descriptive data via self-report and assessment instruments, that would hopefully increase the understanding and the 'quality' of the quantitative research findings.

Reliability Issues

The reliability of an instrument is a measure of how consistent or trustworthy the instrument is in measuring the performance of the assessed variable, and indicates how much variation may be expected on the instrument. Reliability is determined when the same group is measured more

than once, if two different forms of the instrument are used, or when one part of an instrument is compared against another part of the same instrument. Reliability estimates or coefficients vary between 0.00 – 1.00 (Fraenkel and Wallen, 2000). For the purpose of this investigation, two forms of reliability testing were conducted, namely (i) test-retest, and (ii) internal consistency reliabilities.

Test-retest reliability (i.e. cloze pre- and post-tests) is performed on an instrument that is administered at least twice to the same group. Fraenkel and Wallen (2000) recommend a time-span of 2 – 3 months between test administrations for educational research. In the case of this study, the cloze test administrations were conducted simultaneously for both the Treatment and the Control groups, with the pre- and post-tests conducted 8 weeks apart. According to the hypotheses made, the ideal test-retest (i.e. pre- and post-intervention) reliability scores should yield a reliability coefficient *r*-value approaching 1.00 for the Control group (i.e. reliable), and .00 for the Treatment group (i.e. unreliable). The test-retest reliability coefficient value between the cloze pre-test and post-test scores for both the Treatment and Control groups were be reported by means of the Spearman's rho (ρ) coefficient (or its parametric Pearson's *r equivalent*) at the $p < .05$ significance level.

The internal consistency reliability coefficient is determined by a single administration of the cloze test instrument (i.e. pre-test scores). This study employed the Kuder-Richardson 20 (K-R #20) formula, and no assumption that all the items are of equal degree of difficulty was made (i.e. different parts of speech, phrases, cues etc.). The cloze test was treated as an objective-type test, as synonyms were not accepted as correct answers, resulting in only one correct answer per item. The 100 items were scored in a dichotomous fashion, where right responses scored '1' mark, and wrong responses scored '0' marks (Fraenkel and Wallen, 2000). The internal consistency reliability coefficient was determined between the first and last 50 responses, and reported for the entire complement of the Treatment, Control, and Comparison groups. The rule of thumb recommended by Fraenkel and Wallen is to accept a reliability coefficient of .70 or greater as being statistically acceptable.

Inter-Rater Reliability

Differences in the four constituents of the reciprocal teaching protocol, namely Summarizing, Questioning, Predicting, and Clarifying, are more subjective in their determination than changes in the objectively scored cloze pre- and post-test raw scores. This resulted in concerns over the inter-rater reliability of the descriptive measures obtained. Inter-rater reliability indicates the scoring differences between different observers (Fraenkel and Wallen, 2000). Inter-rater consistency was sought by having subject matter experts assist in the development and evaluation of the assessment rubrics, and by practicing the coding of the assessments with the use of the pilot-study data. It was predetermined that all items should have a minimum inter-rater reliability score of .90 (Bastick and Matalon, 2004) between the two principal subject matter experts, failing which the expertise of a third rater would be employed to break the deadlock. The non-parametric Spearman's rho (or its parametric equivalent, the Pearson's product-moment reliability coefficient *r*-value) between the averages of each of the SME's ratings were determined and reported as the indicator of their inter-rater reliability scores.

Objectivity

Absolute objectivity, or the absence of unknown or 'unbiased' subjective judgment, was a difficult trait to achieve in a partly descriptive study such as this. However, every effort was made on the part of the researcher and raters to be honest, fair, and consistent throughout the duration of the study. Objective-type instruments were used where feasible (e.g. the quantitative pre- and post-test data). An inter-rater reliability ($r > .90$) (Bastick and Matalon, 2004), determined by means of the Spearmen's rank-order rho (ρ) (or its parametric equivalent, the Pearson's r) coefficient at the $p < .05$ significance level, was sought at all times for the descriptive data, through the use of researcher-SME's collaboratively developed rubrics, copies of which have been included in the Appendices (see Appendix C).

Data Triangulation.

In order to minimize the effects of researcher error and bias on the outcomes of this study, the researcher resorted to the method of *data* triangulation (Patton, 1997). Here the researcher sought to corroborate the quantitative data obtained (e.g. cloze pre- and post-test raw scores), with the descriptive data obtained (e.g. questionnaire self-reports), checking for consistency and agreement between the data obtained. It was anticipated that this approach would provide the essential data to be used which guided the study into making a valid conclusion re the efficacy of the reciprocal teaching methodology on positively impacting the group-mean reading-comprehension performance of the first-year Industrial Technology teacher-education majors, as well as to develop 'profiles' of the typical participants of the study. This information was useful in guiding the application and utility of the study.

Instrument Usability

All of the instrumentation utilized in this study are researcher-developed. During their development, and in addition to their validity and reliability concerns, the researcher took into consideration their ease of use, expected completion time, clarity and readability, gender-bias, cost, and the scoring and interpretation of the results. The instruments were vetted by two subject matter experts, and received satisfactory appraisals from both of them (i.e. good inter-rater reliability). In addition, all instruments were pilot-tested on at least two occasions, and modifications were made where necessary to improve the product.

Participant Sampling

Research Participants.

In light of the recommended use of the quantitative term "subjects" and the qualitative term "informants" posited by Krathwohl (1991), this study describes the first-year UTech student-volunteers who took part in the research as "participants" (Krathwohl). These "participants" were further described as being Industrial Technology teacher-education majors, non-Industrial Technology teacher-education majors (for students enrolled in the Faculty of Education and Liberal Studies – FELS), or non-FELS majors for participants enrolled outside of the teacher-education programs offered by FELS.

Characteristics of the Population.

The primary population studied was the first-year, full-time Industrial Technology teacher-education majors enrolled during the 2013/14 academic year at the Papine (i.e. main) campus of the University of Technology, Jamaica. Traditionally, this group of students have shown typically weak reading-comprehension skills when anecdotally compared with students enrolled in the other four faculties and two colleges at the same institution. For comparative purposes, full-time, first-year students enrolled in FELS, but not the Industrial Technology specializations, and students recruited from outside of FELS were also included in the study. All students satisfied the minimum UTech matriculation requirements of five (5) Caribbean Examination Certificate (CXC) passes, including English Language and Mathematics. However, due to the competitive nature of qualified applicants, and the limited number of 'seats' available, several applicants, especially those deemed as the 'weaker' ones, were forced to enter a faculty other than their faculty of first choice. Furthermore, some of these students indicated their reluctance to enter the teaching profession upon graduating from this teacher-training program. These possibly demotivating effects were not entirely investigated in this study.

There were 48 students enrolled in the Fall (i.e. Semester 1) 2013/14 Industrial Technology teacher-education majors' cohort as follows: Construction Technology ($n_{CT} = 28$), Electrical Technology ($n_{ET} = 15$), and Mechanical Technology ($n_{MT} = 5$). There were six female ($n_f = 6$) and forty-two male students ($n_m = 42$), both groups with ages ranging between 17 years and 26 years of age as of the start of the academic year (i.e. September 1, 2013). Two participants started the academic year being under 18 years of age. However, prior to the start of the collection of data, they both attained the age of majority (i.e. 18 years old). Only 42 of these students were willing and able to participate in the study for a variety of personal reasons. No attempt was made to analyze the data collected according to gender, age, industrial specialization, nor school type attended, due to the small and unequal representation of each group.

Participant Profiles

A comparative gender analysis of the demographics of the three groups, the FELS-IT ($n_{FELS\text{-}IT} = 42$), the FELS-non-IT ($n_{FELS\text{-}non\text{-}IT} = 40$), and the non-FELS ($n_{non\text{-}FELS} = 51$) groups, revealed that for the FELS-IT group, five (12%) are female, and 37 (88%) are male. For the FELS-non-IT group, 23 (58%) are female, and 17 (42%) are male. For the non-FELS group, 21 (41%) are female, and 30 (59%) are male. Thus, this study utilized the data from 133 (100%) volunteer first-year participants, of which 49 (37%) are female, and 84 (63%) are male (see Table 3-1). The researcher assumed that for the 2013/4 academic year, the gender enrollments adequately represents a typical student in-take for any year at UTech. It was further assumed that the conveniently sampled group of participants utilized in this study was also representative of a typical selection of students for any academic year. It should be noted that throughout the demographic analyses of this study, all percentages were rounded off to their nearest whole number, and are given as a percentage of the entire row in each table unless indicated otherwise.

Table 3-1
Number of Participants and Gender Breakdown by Group in Percentages

Group	Number of Participants (%)	Female (%)	Male (%)
FELS-IT	42 (100%)	5 (12%)	37 (88%)
FELS-non-IT	40 (100%)	23 (58%)	17 (42%)
Non-FELS	51 (100%)	21 (41%)	30 (59%)
Total	133 (100)	49 (37%)	84 (63%)

Analysis of the general profiles of the FELS-IT participants ($n_{FELS\text{-}IT} = 42$) who formed the Treatment and Control groups for this study revealed that of the 42 participating students, 24 (27%) reported being in the 18-22 year old range (as of September 1, 2013) and 18 (55%) reported being over 22 years of age. Twenty (21%) of these 42 participants attended a Jamaican Traditional High (i.e. Secondary) school, 12 (67%) attended a Technical High School, and 10 (45%) a New Secondary/Comprehensive School. Twenty-four (57%) of the FELS-IT first-year (i.e. freshman) intake reported that FELS was their faculty of first choice when seeking admission to UTech (see Tables 3-2 and 3-3).

Table 3-2
General Profiles of Age Range and School Type by Group and Gender Percentages

General Profiles	**FELS-IT**			**FELS-non-IT**			**Non-FELS**		
Age Range (Yrs.)	**Female**	**Male**	**Total**	**Female**	**Male**	**Total**	**Female**	**Male**	**Total**
< 18	0	0	**0**	4	0	**4**	2	4	**6**
(n = 10)	(0%)	(0%)	**(0%)**	(40%)	(0%)	**40%)**	(20%)	(40%)	**60%)**
18 – 22	3	21	**24**	22	9	**31**	13	22	**35**
(n = 90)	(3%)	(24%)	**(27%)**	(24%)	(10%)	**34%)**	(14%)	(25%)	**39%)**
> 22	2	16	**18**	3	2	**5**	6	4	**10**
(n = 33)	(6%)	(49%)	**(55%)**	(9%)	(6%)	**15%)**	(18%)	(12%)	**30%)**
Total	**5**	**37**	**42**	**29**	**11**	**40**	**21**	**30**	**51**
(n = 133)	**(4%)**	**(28%)**	**(32%)**	**(22%)**	**(8%)**	**30%)**	**(16%)**	**22%)**	**38%)**
School Type									
	Female	**Male**	**Total**	**Female**	**Male**	**Total**	**Female**	**Male**	**Total**
Trad. High	3	17	**20**	21	10	**31**	18	24	**42**
	(3%)	(18%)	**21%)**	(23%)	(11%)	**34%)**	(19%)	(26%)	**45%)**
Tech. High	0	12	**12**	0	4	**4**	2	0	**2**
	(0%)	(67%)	**67%)**	(0%)	(22%)	**22%)**	(11%)	(0%)	**11%)**
New Sec./ Comp.	2	8	**10**	2	3	**5**	1	6	**7**
	(9%)	(36%)	**45%)**	(9%)	(14%)	**23%)**	(4%)	(28%)	**32%)**
Total	**5**	**37**	**42**	**23**	**17**	**40**	**21**	**30**	**51**
	(4%)	**(28%)**	**(32%)**	**(17%)**	**13%)**	**30%)**	**(16%)**	**22%)**	**38%)**

Further comparative analysis of the profiles of the FELS-IT group ($n_{FELS\text{-}IT}$ = 42, where $n_{FELS\text{-}IT}$ = Treatment (n_{Treat} = 19 or 45%) plus Control (n_{Cont} = 23 or 55%) groups) revealed that of the 19 Treatment group participants, 15 (36%) are male, and four (9%) are female. Twelve (50%) reported being in the 18-22 years of age group (10 males and two females), and seven (39%) report being over 22 years of age (five males and two females). Six (30%) of the Treatment group participants attended a Jamaican Traditional High School (all males), whereas nine (75%) attended a Technical High School (all males). Four participants (40%) attended a New Secondary/Comprehensive School (all females). Eleven (46%) participants (4 female and 7 male) in the Treatment group indicated that FELS was their faculty of first choice when seeking admission to UTech (see Table 3-3).

For the Control group (n_{Cont} = 23 or 55% of $n_{FELS\text{-}IT}$), 22 (53%) are male, with one (2%) female representative. Twelve (50%) participants (11 male and one female) from this group report being in the 18-22 years of age range, while 11 (61%) report being in the over 22 years old group (all

males). Fourteen (70%) attended a Traditional High School (13 males and one female), three (25%) a Technical High School (all males), and six (60%) a New Secondary/Comprehensive School (all males). Of this cohort, 13 (54%, all males) indicated that FELS was their faculty of first choice (see Table 3-3).

Table 3-3
General Profile Showing Age Range, School Type Attended, and Admission to Faculty of First-Choice for Treatment and Control Groups by Gender

General Profile	**Treatment Group**			**Control Group**		
	Female	Male	Total	Female	Male	Total
Age Range (Years)						
< 18	0	0	**0**	0	0	**0**
(n = 0)	(0%)	(0%)	**(0%)**	(0%)	(0%)	**(0%)**
18 – 22	2	10	**12**	1	11	**12**
(n = 24)	(8%)	(42%)	**(50%)**	(4%)	(46%)	**(50%)**
> 22	2	5	**7**	0	11	**11**
(n = 18)	(11%)	(28%)	**(39%)**	(0%)	(61%)	**(61%)**
Total	**4**	**15**	**19**	**1**	**22**	**23**
(n = 42)	**(9%)**	**(36%)**	**(45%)**	**(2%)**	**(53%)**	**(55%)**
School Type						
Traditional High	0	6	**6**	1	13	**14**
	(0%)	(30%)	**(30%)**	(5%)	(65%)	**(70%)**
Technical High	0	9	**9**	0	3	**3**
	(0%)	(75%)	**(75%)**	(0%)	(25%)	**(25%)**
New Sec./ Comp. High	4	0	**4**	0	6	**6**
	(40%)	(0%)	**(40%)**	(0%)	(60%)	**(60%)**
Total	**4**	**15**	**19**	**1**	**22**	**23**
	(9%)	**(36%)**	**(45%)**	**(2%)**	**(53%)**	**(55%)**
Admitted to Faculty of 1st Choice	4	7	**11**	0	13	**13**
	(17%)	(29%)	**(46%)**	(0%)	(54%)	**(54%)**

With respect to the reported age distribution as of the September 1, 2013 reference date, for the FELS-IT group, 24 (57%) of these 42 participants are in the 18-22 years of age range (21 males and three females), and 18 (43%) are over 22 years old (16 males and two females, see Table 3-3). Broken down further, for the Treatment group only (n_{Treat} = 19), 12 (63%) are in the 18-22 years old range (10 males and two females), while seven (37%) are in the over 22 years old

group (five males and two females). For the Control group only (n_{Cont} = 23), 12 (52%) are in the 18-22 years old range (11 males and 1 female), and 11 (48%) are in the over 22 years old group (all males, see Table 3-2).

For the FELS-non-IT group ($n_{FELS\text{-}non\text{-}IT}$ = 40 or 30%), four (40%) of the cohort of 10 group members reported being under 18 years of age on the reference date (all females). Thirty-one (34%) participants of their respective cohort report being in the 18-22 years old age range, of which nine (10%) are male, and 22 (24%) are female. Two (6%) male participants of this cohort report being over 22 years of age, and three (9%) females also report being over 22 years of age (see Table 3-2).

The non-FELS ($n_{non\text{-}FELS}$ = 51) group report for the respective cohort, four (40%) males and two (20%) females as being under 18 years of age, 22 (25%) males and 13 (14%) females as being in the 18-22 years old range, and four (12%) males and six (18%) females as being over 22 years of age on the reference date (see Table 3-2).

The participants' profile questionnaire also reflected on the type of secondary school that each participant attended. The data revealed that for the FELS-IT group, 20 (21%) attended a Traditional High School (three females and 17 males), 12 (67%) attended a Technical High School (all males), and 10 (45%) attended a New Secondary/Comprehensive High School, two of which are female and eight males (see Table 3-2).

When examined according to Treatment or Control group, six (30%) male and no (0%) female from the Treatment group attended a Traditional High School, while 14 (70%), 13 males and 1 female from the Control group attended a Traditional High School. Nine (75%) male participants from the Treatment group attended a Technical High School, whereas three (25%) participants, all male, from the Control group attended a Technical High School. No female participant from the FELS-IT group attended a Technical High School. There are six (60%) male participants from the Control group who attended a New Secondary/Comprehensive High School (no females), whereas no (0%) male from the Treatment group, and four (40%) females from the Treatment group attended a New Secondary/Comprehensive High School (see Table 3-3).

Of the FELS-non-IT participants, 10 (11%) male and 21 (23%) female participants attended a Traditional High School. Four (22%) males with no female attended a Technical High School, and three (14%) male and two (9%) females attended a New Secondary/Comprehensive High School.

For the non-FELS participants, twenty-four (26%) males and 18 (19%) females attended a Traditional High School, only two (11%) females (no males) attended a Technical High School, and six (28%) males and one (4%) female attended a New Secondary/Comprehensive High School.

When asked to identify their preferred learning-style, the results for the FELS-IT group were at best inconclusive. Many participants failed to indicate a preferred style, and many others indicated a combination of two or three styles, despite being instructed to specify "one" option.

However, a crude observation seems to indicate that "viewing" (≈ 60%) was the most popular preference, followed by "hearing" (≈ 30%) and "reading" (≈ 10%) among this group.

Both the FELS-non-IT and the non-FELS groups responded to the question regarding learning preference as per instruction. For the FELS-non-IT group, three (20%) female participants and seven (47%) male participants indicated that they learned best by "hearing." Four (29%) female and three (21%) male participants indicated that they learned best by "reading." Sixteen (26%) female and seven (11%) male participants indicated that they learned best by "viewing." For this group, a total of 10 (67%) participants identified their learning preference as "hearing," seven (50%) as "reading," and 23 (37%) as "viewing," from their respective cohorts.

For the non-FELS group, one (6%) female and four (27%) male participants indicated a preference for 'hearing,' whereas four (29%) females and three (21%) males indicated a preference for 'reading.' Sixteen (26%) female and 23 (37%) male participants from this group indicated a preference for 'viewing,' for a total of five (33%) participants identifying their learning preference as being 'hearing,' seven (50%) as 'reading,' and 39 (63%) as 'viewing.' Table 3-4 summarizes this data.

Table 3-4
Perceived Learning Preference by Group and Gender

Perceived Learning Preference	FELS-IT Group			FELS-non-IT Group			Non-FELS Group		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
Hearing	-	-	-	3 (20%)	7 (47%)	**10 (67%)**	1 (6%)	4 (27%)	**5 (33%)**
Reading	-	-	-	4 (29%)	3 (21%)	7 **(50%)**	4 (29%)	3 (21%)	**7 (50%)**
Viewing	-	-	-	16 (26%)	7 (11%)	**23 (37%)**	16 (26%)	23 (37%)	**39 (63%)**

With regard to the numbers of textbooks and chapters read, as well as numbers of books and chapters read for personal interests and pleasure in the past six months, the responses were not clear. Several respondents from each of the three groups replied "many" or "a lot." However, the most frequent numerical response, if answered, was zero. The maximum number of textbooks read recorded was 36, and 96 chapters; however, this unique response could be viewed as an outlier.

In response to their initial self-perceived reading-comprehension skills, on a scale of one to 10, with one being 'very weak', and 10 being 'very strong,' when rounded off to the nearest whole number, the FELS-IT group rated themselves, on average, as being a seven out of 10, whereas the FELS-non-IT and non-FELS groups both rated themselves as being an eight out of 10. This represents a relatively high and confident self-perception rating across all three groups being

investigated. However, these self-perceived reading-comprehension ratings were not reflected in the cloze-test pre-test assessment scores, which indicated that an overwhelming majority of the participants' reading-comprehension in all three groups performed at the frustration level (74%), or the instructional level (21%), with only 5% of the total number of participants reading at the independent reading level.

The majority of the participants had self-perception rating scores about their reading-comprehension skills of between five and eight. It was interesting to note that six of the respondents rated their reading-comprehension skills as being 10 out of 10 (or "very strong"). Yet, when asked if they believed that their reading-comprehension could be improved, each of these participants responded "yes." It could be that these participants were cognizant of the fact that everyone's reading-comprehension can always be improved.

When asked to indicate the English Language modules in which they were enrolled, the participants responded as follows: from the FELS-IT group, 36% were enrolled in Fundamentals of Communication, 19% in Academic Writing 1, and 45% "none." From the FELS-non-IT group, the percentages were: Fundamentals of Communication (22%), Academic Writing 1 (22%), and "none" (56%). From the non-FELS group, the percentages were: Fundamentals of Communication (12%), Academic Writing 1 (32%), Academic Writing 2 (4%), and "none" (52%). These findings are consistent with the general observation that many students postpone taking modules on topics with which they have challenges until it becomes absolutely necessary for them to do so, some even to the point that they cannot graduate until they complete these 'first-year' modules. By so doing, they miss out on the benefits they could have obtained by taking these modules earlier.

The participants were also asked to indicate whether or not they had taken a reading-comprehension diagnostic test and/or reading-comprehension intervention prior to entering UTech. Only four (10%) respondents from the FELS-IT group had affirmative answers, two (5%) from the FELS-non-IT group, and three (6%) from the non-FELS group. Again, this finding is not surprising, as diagnostic testing is not frequently conducted in the Jamaican educational system.

The researcher collected additional data on several secondary measures, to be used for subsequent analyses. One such measure was the average total time taken per group to complete the tests. It should be noted that the participants were instructed that the tests were not time-restricted, that is, they had unlimited time available to complete them (in an attempt to secure the best performance per participant). The average time taken per group (reported in minutes) was: FELS-IT pre-test = 57.81, FELS-non-IT pre-test = 46.97, and non-FELS pre-test = 50.29. The Treatment groups' (a sub-set of the FELS-IT) pre-test took an average of = 60.32, while the Control group pre-test, on average, took 55.30. On the post-test measure, the average time taken by the FELS-IT group (both Treatment and Control groups combined) was 55.54, whereas the Treatment group took 54.52, and the Control group took 56.57. This information is summarized in Table 3-5.

Table 3-5
Average Time taken on Pre-test and Post-test by Group

Average Time Taken		FELS-IT Group (mins.)		FELS-non-IT Group (mins.)	Non-FELS Group (mins.)
		(Treatment Group)	(Control Group)		
Pre-Test	(57.81)	60.32	55.30	46.97	50.29
Post-Test	(55.54)	54.52	56.57	-	-

Participant Selection Procedure

There were a total of one hundred and thirty-three (N = 133) participants directly or indirectly involved in this study. They were all Jamaican volunteers drawn from the full-time, first-year student population. There were forty-two Industrial Technology teacher-education majors (n_{IT} = 42) from the School of Technical and Vocational Education (SOTAVE), and two comparison groups of forty first-year FELS non-Industrial Technology majors ($n_{FELS\text{-}non\text{-}IT}$ = 40), also drawn from SOTAVE, and fifty-one non-FELS students ($n_{non\text{-}FELS}$ = 51). All the participants were enrolled, full-time students at the University of Technology, Jamaica, for the 2013/14 academic year.

The Industrial Technology teacher-education majors were divided into three areas of specialization, namely Construction Technology (CT), Electrical Technology (ET), and Mechanical Technology (MT), according to their area of specialization. However, this study made no attempt to compare the findings between these groups, primarily due to the small and unequal sizes of the number of students enrolled in each specialization.

The researcher met with the potential participants of the Treatment and Control groups during the start of the Fall semester, sensitized them to the purpose of the study, and solicited their voluntary participation. Student were given letters inviting them to participate (see Appendix D), and was briefed, as a group, about the researcher's expectations of them and their responsibilities should they elect to participate in the study. Each student was also given an Informed Consent Form (see Appendix E) to be signed and returned within three days if they wished to be considered to participate in the study. The initial favorable response rate was 42 or 88% (N = 48).

The Comparison group (i.e. FELS non-IT ($n_{FELS\text{-}non\text{-}IT}$ = 40) and non-FELS ($n_{non\text{-}FELS}$ = 51) was formulated differently from the experimental FELS IT group (i.e. Treatment and Control groups). Whereas I solicited all the enrolled Industrial Technology students to participate in the experimental group, the members of the Comparison group were recruited by means of a convenience sampling from across the University population. They were invited to participate in a "data collection exercise", and instructed to meet in the classroom at the specified date and time. Here they were informed of the purpose of the study they were being asked to participate

in, the researchers' expectations of them, and their rights as volunteer participants. They were asked to indicate their willingness to participate in the study by completing and submitting the Informed Consent form.

For the experimental group, once the available number of potential Treatment and Control group volunteers was established (based on available enrollment figures), the researcher met with all of the participants at a mutually convenient time, which was set for Thursday afternoons at 2:00 p.m. The period 3:00 p.m. – 5:00 p.m. is allotted for students to attend University Clubs and Society meetings. The 2:00 p.m. – 3:00 p.m. hour was deemed suitable for the regular weekly meetings by the overwhelming majority of the students, as they did not have scheduled classes at this time.

The assignment of the Industrial Technology participants to either the Treatment or the Control groups was arbitrarily determined after the cloze pre-test was administered and graded. The pre-test scores were mechanically matched by the researcher as closely as possible into pairs, and two groups were randomly formed. Up until this point, the participants were identifiable only via the use of the last four digits of their 8 digit UTech student identification numbers. One participant from each pair from the two lists was then presented to a colleague, who 'randomly' assigned a participant to a group by means of a coin-toss. This group was hereafter known as the "Treatment" group. The other paired participant was assigned to the group which was, by default, named the "Control" group.

In order to answer the second research question, the researcher used SPSS (v16) and JMP Pro 11 software (i.e. the parametric students *t*-test (unrelated) and its non-parametric equivalent, the Mann-Whitney U test) to statistically compare the group-mean cloze pre-test scores of the combined Treatment ($n_{Treat} = 19$) and Control ($n_{Cont} = 23$) groups (i.e. all the Industrial Technology teacher-education majors, $n_{IT} = 42$, or experimental group) with those of the first-year, full-time volunteer groups of a proportionally stratified sampling of non-Industrial Technology participants, and non-FELS participants. The 40 FELS non-Industrial Technology volunteers were recruited from among the FELS students who were not enrolled in the Industrial Technology options. The non-FELS volunteers were stratified according to the participants' Faculty and School of enrollment. This group consisted of 51 members (i.e. $n_{Comp} = 51$), with approximately ten participants conveniently recruited from across each of the four Faculties and two Colleges within the university.

The primary consideration used to determine which volunteers to accept for the Comparison and Experimental (i.e. Treatment and Control) groups was the age of the potential participants, as some ($n = 5$) respondents were pursuing in-service diplomas or a second first-degree, and were therefore not only significantly chronologically older, but mentally more experienced and developed, despite qualifying as first-year undergraduate degree students. The researcher used only the data of volunteer participants who were between 17 – 25 years of age on September 1, 2013 in this study.

Participant Units

The 'sampling' units used to collect data for the purposes of this study were of necessity two-fold. The data analyses were primarily conducted at the group level, with one exception. With

the exception of hypothesis statement H_1 1e, all other hypotheses (i.e. H_1 1a – H_1 1d and H_1 2) were analyzed at the group sampling unit level, and not at the individual participant level. Hypothesis H_1 1e sought to determine if the *individual* post-test – pre-test gains made by the Treatment group participants' were statistically significant, which necessitated analyses at the individual level. The group-mean pre-test, post-test, and mean-gain score data were statistically analyzed by means of the SPSS (v16) and JMP Pro 11 software packages on the researchers' personal laptop computer and UTech and VPISU office computers, and reported.

For the descriptive elements of the study, the sampling units were the individual participants' responses to the probing entry and exit questionnaires and interview protocols. As the researcher sought to obtain a deeper and richer understanding of the thought patterns and perceptions of the participants beyond the significance of a single statistic, the individual responses of the participants to the interviews and entry- and exit questionnaires were empirically content-analyzed. In addition, a focus-group interview of the Treatment group was conducted, in which the participants were encouraged to express themselves freely on an individual basis. It was anticipated that this strategy provided a means of external motivation to the members of this group, eliciting information that might otherwise be unnoticed if they were interviewed individually and not as a group. This information enabled the researcher to develop a 'profile' of the typical study participants.

Size of Participant Groups

In order to compile valid quantitative data that would allow the researcher to address the research questions identified in this study, it was determined that a minimum group size of 15 participants was required, as suggested by Fraenkel and Wallen (2000). However, in anticipation of the reality that there might be students who for whatever personal reasons or otherwise choose to discontinue their involvement in the study, or disqualify themselves (e.g. infrequent attendance), it was proposed to use a group size of approximately 20 participants each for the Treatment and Control groups. Consideration was also given to the manageability of the intervention sessions by the researcher, should the group become too unwieldy. There are four major components to the most popularly cited variation of the Reciprocal Teaching methodology (Palincsar and Brown, 1984; Rosenshine and Meister, 1993, 1994). Therefore, it was intended to keep the total number of participants in the Treatment group to a multiple of four, and to keep the size of the Control group equal to the size of the Treatment group (i.e. $n_{Cont} = n_{Treat} = 20$) under ideal circumstances.

The use of two (i.e. Treatment and Control) groups of 20 participants per group ($n = 40$) represents eighty-three per cent (83%) of the total cohort of first-year, full-time Industrial Technology teacher-education majors enrolled in the 2013/14 academic year. Ideally, all students (i.e. 100%) should be included in this study, that is, "The larger the sample, the better" (Leedy and Ormrod, 2001, pg. 221). However, since this study did not currently aim to generalize its findings beyond the first-year Industrial Technology teacher-education majors at UTech from where the participants are drawn, these group-sizes were considered to be practical and adequate to meet the purposes of this study by the researcher (see Patton, 1997). For the descriptive analysis of the research data, the opinions of 20 participants were considered adequate to reveal any recurring themes, should they exist. For the quantitative (i.e. *quasi*-experimental) component

of the study, group sizes with a minimum number of 15 participants per group are considered acceptable, as recommended by Fraenkel and Wallen (2000):

> For descriptive studies, we think a sample with a minimum number of 100 is essential. For correlation studies, a sample of at least 50 is deemed necessary to establish the existence of a relationship. For experimental and causal-comparative studies, we recommend a minimum of 30 individuals per group, although *sometimes experimental studies with only 15 individuals in each group can be defended if they are very tightly controlled;* studies using only 15 subjects per group should probably be replicated, however, before too much is made of any findings that occur. (Fraenkel and Wallen (2000), pg. 118, *italics supplied*).

Thus, the researcher considered the data collected to be adequately both valid and an accurate representation of the performances and perceptions of the participants with regards to the topic under investigation utilizing the quasi-experimental research approach.

Departures from the Original Research Design

A good research design represents what the researcher considered to be the most effective and efficient manner to collect valid and reliable data for the purpose of directly addressing the research question(s). Thus, the design selected represents the ideal procedure to be followed throughout the study. However, and especially in the case of educational research, it is not always feasible to implement the research methodology as was ideally proposed. In the case of this study, the researcher was confined to utilize the maximum number of 48 enrolled students in the 2013/2014 Industrial Technology program, to which the researcher desired to focus the study and its findings on.

To begin with, participation in the study is totally voluntary. Of the 48 possible candidates, six, or approximately 13%, although willing to participate, were unable to accommodate the schedule of the study, as they had to be at work then. Of the remaining 42 potential participants, six either had no class on a Thursday, and lived too far away to economically afford to attend the intervention sessions, or had prior personal obligations, and therefore declined the offer to participate as members of the Treatment group. This resulted in changes being made to the 'mechanically matched' assignment to the Treatment group, with six members being replaced by six persons originally assigned to the Control group.

Although the replacements to the Treatment group were made by individuals who scored similarly to the participants being replaced, the replacements also had to 'fit the profile' of the individuals being replaced. The effect of these replacements was to increase the cloze pre-test group-mean score of the Control group with respect to that of the Treatment group as initially intended by the use of the mechanical matching on the cloze pre-test scores. Thus, it seems that, on average, six of the better 'Treatment' group performers became 'Control' group members, and in the process, lowered the group-mean score of the final Treatment group, while simultaneously increasing the group-mean score of the Control group. However, the statistical analysis methodology was able to factor in this discrepancy, and detected and compared the performances of both modified groups admirably.

A second point of departure from the proposed research methodology was the implementation of the reciprocal teaching strategy itself. Initially, the researcher intended to implement the strategy to all of the Treatment group as a single group. However, even the logistics of getting the participants to meet on a regular basis at the specified time proved to be a major challenge. Whereas the students were theoretically available on the day and time mutually agreed upon, group-work, study sessions, unforeseen events, and even make-up classes adversely impacted the smooth delivery of the intervention as it was initially designed. Furthermore, and even during the pilot-study sessions, effectively implementing the reciprocal teaching strategy to over 20 participants at a time was indeed a new experience to the researcher, and another major challenge.

The most welcomed suggestion from the reciprocal teaching Subject Matter Experts to break the Treatment group into sub-groups actually solved a variety of problems, as the participants were able to self-select their sub-groups, and determine a mutually conducive meeting time outside of the designated day and time for regular attendance. This action actually improved the punctuality and enthusiasm of the participants, and simultaneously made the implementation task more manageable on the part of the researcher. It should be noted that the major data collecting activities were still held on Thursdays, between 2:00 – 4:00 p.m., as this was deemed most convenient for all of the participants, and was the time when a suitable large room was available. However, the participants did not seem to mind being asked to attend the session as a one-of event. It appeared that the frequent appointment was more of an issue with most of the volunteers, as it cut into their personal time.

Methods of Data Collection

The strategies followed to collect valid, reliable, and therefore meaningful data for analysis and subsequent interpretation are outlined for each specific research question and hypothesis statement investigated. The instrumentation, along with the intervention procedures and statistical tests are also reported. Each primary research question is indicated, along with its respective null hypothesis (H_o) statement.

The researcher utilized a quantitative approach to determine the incidence and extent of the anticipated reading-comprehension change-scores. A Matching-Only Pre-test – Post-test Control Group Design was used to collect the experimental research data analyzed. Both the Treatment and Control groups (in addition to the Comparison group) were pre-tested using the researcher-developed cloze-type instrument. The participants from the Treatment and Control groups were then mechanically matched (as best as possible) on their cloze pre-test (i.e. raw) scores, and one member of each pair formed was randomly assigned to the group that subsequently became the Treatment group. The other member was automatically placed in the eventual Control group.

The reciprocal teaching intervention was conducted with the Treatment group over a ten-week period, after which both the Treatment and Control groups were administered a post-test, utilizing the same researcher-developed cloze-type test instrument used for the pre-test. The Control group did not receive the intervention; neither did the Comparison group receive the intervention nor the post-test administration.

1. Does the reciprocal teaching method improve reading-comprehension among first-year

Industrial Technology teacher-education majors at UTech?

Research Question 1 sought to determine the effectiveness of the reciprocal teaching intervention in positively impacting the group-mean reading-comprehension score for the Treatment group. In response to the question, the researcher conducted four tests of statistical significance on the group-mean pre-test and post-test scores of the Treatment and Control groups, and one test on the individual performances of the Treatment group participants, using the appropriate parametric and their equivalent non-parametric tests.

It was hypothesized that the group-mean pre-test reading-comprehension cloze scores would be statistically equivalent for both the Treatment and the Control groups. Hence, the null hypothesis (H_o 1a) statement tested was:

H_o 1a: The first-year Industrial Technology teacher-education majors' Treatment and Control groups mean pre-test scores will not be statistically equivalent on the researcher-developed cloze test.

Stated mathematically:

H_o 1a: $\mu_{Treat} \neq \mu_{Cont}$ (Pre-test scores)

If the reciprocal teaching instructional methodology was successful in positively impacting the mean reading-comprehension score of the Treatment group, then the researcher surmised that, for this group, its group-mean post-test score would be significantly greater than its pre-test score. This was the basis of the second null hypothesis (H_o 1b). Stated mathematically:

H_o 1b: $\mu_{Post\text{-}test} \leq \mu_{Pre\text{-}test}$ (Treatment Group)

It was further anticipated that, for the Control group, the mean post-test score would be statistically greater than its pre-test score. The null hypothesis (H_o 1c) statement tested was:

H_o 1c: The first-year Industrial Technology teacher-education majors' Control groups' mean post-test score will not be statistically greater than its pre-test score on the researcher-developed cloze test.

Stated mathematically:

H_o 1c: $\mu_{Post\text{-}test} \leq \mu_{Pre\text{-}test}$ (Control group)

It was further hypothesized that the cloze group-mean post-test scores of the Treatment and Control groups would not be statistically equivalent. Null hypothesis (Ho 1d) was formulated as follows.

H_o 1d: The group-mean post-test score of the first-year Industrial Technology teacher-education majors' Treatment and Control groups will be statistically equivalent on the researcher-developed cloze test.

Stated mathematically:

H_o 1d: $\mu_{Treat} = \mu_{Cont}$ (Post-test score)

The fifth hypothesis that was statistically tested compared the individual paired post-test – pre-test (i.e. gain-scores) of the Treatment group participants. It was hypothesized that their post-test scores would exceed their pre-test scores, therefore, the null hypothesis (H_o 1e) tested was:

H_o 1e: $\mu_{Post\text{-}test} \leq \mu_{Pre\text{-}test}$ (Individual Treatment Group members)

2. What reading-comprehension levels are characteristic of first-year Industrial Technology teacher-education majors at UTech?

Reading-comprehension data were collected during the third session with the participants, using the researcher-developed cloze-type test instrument to pre-test all of the volunteers ($n_{Total} = 133$). The participants met at a mutually convenient non-class time, were briefed and subsequently issued the cloze pre-test instrument and answer sheet (see Appendix F). The researcher then read out written instructions to the participants, asked if anyone had any concerns or needed further clarification (which there were none), and then instructed them to "begin".

The cloze-test instrument used consisted of an original passage of 588 words (see Appendix G), taken from a text on the FELS' students 'Highly Recommended' reading list for the module *Introduction to Psychology* (PSY1002). Using the available Spelling and Grammar function in Microsoft Word 2007 software, the Flesch-Kincaid Grade Level of the passage was 11.7, and the Flesch Reading Ease was 38.4. All text-size used were 12 or larger, with Times New Roman font-type. There were no Passive Sentences in the original passage. It should be noted that the cloze test was not administered as a timed test, and that a small incentive of a telephone calling card (JA\$125 ≈ US\$1.08) was given to each participant for their cooperation.

To effectively address Research Question 2, a comparison of reading-comprehension pre-test scores between the FELS Industrial Technology first-year teacher-education majors and the purposively selected sampling of FELS non-IT and non-FELS first-year participants was required. To this end, two groups (for manageability reasons) from the total 133 participants were administered the researcher-developed cloze-type pre-test instrument under identical conditions. One group consisted of the FELS Industrial Technology first-year teacher-education major volunteers ($n_{FELS\text{-}IT} = 42$). The second group, the comparison groups, comprised of the purposively sampled FELS non-IT ($n_{non\text{-}IT} = 40$) and non-FELS ($n_{non\text{-}FELS} = 51$) first-year volunteer students ($n_{Comp} = 91$), drawn from across the UTech Papine (i.e. main) campus.

The raw pre-test scores for each participant were used to categorize the participants as being either at the i) frustration, ii) instructional, or iii) independent reading-comprehension levels (See Bormuth, 1968, and Gillett and Temple, 1990).

Subsequently, both parametric and non-parametric analyses were conducted on the data, as

recommended by Fraenkel and Wallen (2000) and Bastic and Matalon (2004). The parametric *Pearson's r* and its equivalent non-parametric *Spearman's rho* correlation coefficients were computed for each group to determine any between-groups correlation.

These two groups' ($\mu_{FELS\text{-}IT} = 42$, with the $\mu_{FELS\ non\text{-}IT} = 40$ and $\mu_{non\text{-}FELS} = 51$) mean pre-test scores were also investigated for within group correlations, using the parametric *Independent-Groups Student's t-test* (and its non-parametric equivalent, *the Mann-Whitney Test)*, to determine whether these scores were statistically significant at the $p < .05$ level (single-tailed test).

In addition, the non-parametric *Kruskal-Wallis Test* (equivalent to the parametric ANOVA unrelated test) was used to determine the statistical significance of the *three* groups (i.e. $n_{FELS\text{-}IT} = 42$, $n_{FELS\ non\text{-}IT} = 40$, and $n_{non\text{-}FELS} = 51$) for between-groups effects, also at the $p < .05$ level (single-tailed test).

The null hypothesis (H_o 2) tested was:

H_o2: There is no statistically significant difference between the group-mean pre-test reading-comprehension scores of the FELS first-year Industrial Technology teacher-education majors ($\mu_{FELS\text{-}IT}$) and the FELS non-IT ($\mu_{FELS\ non\text{-}IT}$) and non-FELS ($\mu_{non\text{-}FELS}$) first-year students.

Stated mathematically:

H_o 2: $\mu_{FELS\text{-}IT} = \mu_{FELS\ non\text{-}IT} = \mu_{non\text{-}FELS}$

If the FELS first-year Industrial Technology teacher-education majors had a relative reading-comprehension problem, then this null hypotheses should be rejected.

After administering the reciprocal teaching intervention to the Treatment group only, post-test data for all of the first-year Industrial Technology teacher-education majors (i.e. Treatment and Control groups, $n_{IT} = 42$) were collected using the same pre-test cloze instrument as a post-test instrument during session ten with the participants. This data allowed for the group-mean gain-scores determination and their analyses to be conducted.

3. What are UTech Industrial Technology teacher-education majors' perceptions of the strengths, weaknesses, and effectiveness of the Questioning and Summarizing reciprocal teaching intervention sub-strategies?

Prior to the implementation of the reciprocal teaching intervention, all of the participants in the Treatment and Control groups were pre-tested on their Summarizing and Questioning skills, and assessed on their textual clarification-seeking and predicting abilities, the four components of the reciprocal teaching model (i.e. Summarizing, Questioning, Clarifying, and Predicting). The materials used for the assessment were taken from Psychology and subject content-area textbooks listed on the FELS' participant's 'Highly Recommended' reading list. These assessments were repeated (i.e. post-tested) after the completion of the reciprocal teaching intervention using equivalent forms of the pre-test documentation.

With the assistance of two Subject Matter Experts, the researcher developed a rubric to score the Summary and Questioning components (see Appendices H and I), and the mean group-score changes for each component were obtained (i.e. post-test – pre-test scores). Null hypotheses were formed, namely that 1) there was no statistically significant difference between the mean pre-test and mean post-test Questioning data scores for i) the Treatment group, and ii) the Control group, and 2) there was no statistically significant difference between the mean post-test Summary data scores of the Treatment and Control groups. These hypotheses were tested and analyzed using the non-parametric Wilcoxon Signed rank test (and its equivalent Student's *t*-test (related)) within each group, and the non-parametric Mann-Whitney test (and its equivalent Student's *t*-test (unrelated)) between the groups respectively.

After the completion of the reciprocal teaching intervention, information was collected from the Treatment group via a self-report instrument (see Appendix J) as to the perceived effectiveness of the intervention. Where deemed necessary, the data collected were explored further in the form of open-ended questions asked during the focus group interview session. The data were coded and analyzed for themes, and reported by the researcher.

Items included on the Entrance Survey instrument explored each participants' reading-comprehension self-concept and perception of whether they had a problem or needed assistance to improve their abilities. Members of the Treatment group were subsequently asked about the impact that each of the four sub-components of the reciprocal teaching strategy had on their self-concept after experiencing the intervention during the focus group interview session. Members of the Treatment group were also asked to rank and report their perceived effectiveness of each of the four reciprocal teaching sub-strategies on their academic development. These data were compared and analyzed for themes by the researcher, and ranked according to their perceived effectiveness by the Treatment group participants.

Instruments and Intervention Procedures

All of the instruments utilized in this study were researcher-developed, and specifically designed to satisfy the needs and culture of this unique study conducted at UTech. This decision was taken to obtain data that would be culture-bias free, efficient, and ecologically pertinent. The intervention procedures are described below, and copies of sample documentation employed are included in the appendices.

Pilot Study

The researcher conducted a pilot study, which is a brief, exploratory investigation conducted to determine the feasibility and potential difficulties that the participants and the researcher might possibly face while undergoing and analyzing an experiment (Leedy and Ormrod, 2001). In this investigation, the pilot study was undertaken by participants with typical characteristics much like the Treatment and Control groups investigated in the actual study in two parts. Its objective was to inform the researcher of the efficacy of the research design along with its instrumentation, and their ability to capture relevant data for further analysis in addressing the various research questions.

All the study instrumentation, inclusive of the cloze pre- and post-tests, questionnaires and the written communication, were assessed by an English Language subject matter expert (SME)

from the School of Humanities and Social Sciences (SHSS) in the Faculty of Education and Liberal Studies. The assessment included checks for item validity, ambiguity, grammar. It ensured there were no leading or psychologically threatening questions in the questionnaire, and whether the participants were likely to provide all of the information that was requested. In addition, the pilot study was used to determine the approximate time required for the participants to complete the 100-item cloze test, to identify any potential fatigue factors during the tests, and to determine if the test instructions were clear and adequate. This pilot study also provided the researcher with practice in delivering the reciprocal teaching methodology, and allowed for a trial run at analyzing the test data collected.

Throughout the study, it was not assumed that participants with a potential reading-comprehension challenge would react decisively and readily comprehend all the written instructions given during the intervention. The implementation of the pilot study allowed the researcher to keep the participants tasks simple, to predict how they would receive and interpret the instruments and intervention sessions, and thereby eliminate some potential problems during the delivery of the actual study.

Furthermore, the pilot study enabled the researcher to identify what does and does not work during the collection of the research data, as the researcher was unable to anticipate some of the problems that arose. For example, the first-year Industrial Technology teacher-education majors did not really know each other. During the Fall semester (i.e. Semester 1) the participants only had one common specialist module (i.e. course), Graphic Communication, that was offered during three time-slots. Furthermore, not all of the participants elected to complete this module during their first-year Fall Semester. Hence, some of them were not well acquainted with their own specialist group members. This was reflected when they were required to form self-selected sub-groups for the reciprocal teaching intervention. To this end, the researcher was able to incorporate several team-building, group-dynamics (i.e. icebreaker) activities into the study to hasten the process of group integration during the study (see Appendix M).

The population for the pilot study consisted of 18 volunteer first-year students taken from the three Industrial Technology teacher-education major programs. The composition of the pilot group, which was repeated, was based on the convenience of available volunteer members during both the Spring (i.e. Semester 2) semesters of the 2010/11 and 2011/12 academic years. The pilot studies, which were conducted on two separate occasions, ran for approximately eight weeks, meeting albeit irregularly each week for a total of seven sessions each, and had their intervention sessions lasting for approximately 40-50 minutes each.

One major discrepancy between the two deliveries of the pilot study and the final research implementation came about by means of recommendation from the researchers' doctoral committee. After viewing the second running of the pilot study, the committee recommended that rather than attempting the unwieldy task of introducing and implementing the reciprocal teaching intervention to such a large group as eighteen volunteers all at once, the researcher should present the reciprocal teaching intervention to smaller groups of 4 – 5 volunteers each. This recommendation was readily adopted, and found to result in an easier and more efficient implementation of the reciprocal teaching intervention.

It should also be noted that it was decided by the researcher that as a gesture of goodwill, a small incentive of a telephone calling-card valued at JA$125.00 (approximately US$1.08) would be provided to each pilot study group member when they completed the cloze pre- and post-tests. This incentive kept the pilot group participants interested in participating in the study without affecting the quality of the data, as it was observed that the attendance and punctuality of some volunteers became somewhat irregular after around week five. The pilot study group was also informed of the importance of not divulging any information about the study and its interventions with any other students, and were promised to be acknowledged in the final report, albeit anonymously, as well as receive a copy of the summary of the findings of the actual study, if requested.

Quantitative Components

The quantitative aspect of this study was designed to determine evidence of the extent to which the reciprocal teaching intervention might positively impact the group-mean reading-comprehension pre-test score of the first-year Industrial Technology teacher-education majors at the University of Technology, Jamaica, as assessed primarily by a researcher-developed cloze-type test instrument. This information was sought utilizing an experimental (i.e. quasi-experimental) research design approach, and as such, special considerations were taken to address the concerns of reliability and validity issues pertinent to the experimental research design. All printed documentation were size 12, Times New Roman font, with at least one-inch margins all around.

Cloze Pre-test

The primary data source used in this study was a researcher-developed cloze-type test instrument. The instrument used consisted of an original passage of 588 words (see Appendix F), taken from a text on the students 'Highly Recommended' reading list for the module *Introduction to Psychology* (PSY1002). Using the Spelling and Grammar function in Microsoft Word 2007 software, the Flesch-Kincaid Grade Level of the intact passage was found to be 11.7, and its Flesch Reading Ease was found to be 38.4. There were no Passive Sentences in the passage. After the first two sentences in the randomly selected passage were presented, then every fifth word was deleted and replaced with a 12 tab underscore-line followed by a number in brackets (e.g. _____ (#)). The respondents were required to read the passage and, using the clues from the context and structure of the passage, identify each missing word. Their interpretation of the missing words were recorded on a numbered answer sheet (see Appendix F) corresponding to the blank item-number on the cloze passage. There were 100 such missing words, 50 each in two independent passages. The cloze test was not administered as a timed test.

Descriptive Components

Whereas the quantitative component of the study sought to determine if there was a group-mean gain-score on the dependent variable that could be attributed to the independent variable, the more descriptive-type elements sought to address just how superior this difference score was in terms of its 'quality.' The version of the reciprocal teaching strategy employed in this study consisted of four sub-components, namely (i) Summarizing, (ii) Questioning, (iii) Clarifying, and (iv) Predicting (Palincsar and Brown, 1984). To this end, pre-test and post-test scores or assessments were collected from both the Treatment and Control groups, based on these factors,

with special emphasis being placed on the more readily discernible and quantifiable Summarizing and Questioning components.

Descriptive Data.

The descriptive components of this study sought to obtain a measure of "how well" reciprocal teaching was able to impact the reading-comprehension capabilities of the exposed participants. Participants were asked to respond to researcher-developed instruments that assessed their affective sphere of influence. These self-reports were then examined and compared for themes and trends using descriptive statistics.

Summary data. All the participants in both the Treatment and Control groups were required to complete two Summary assessments. These passages were taken from textbooks actually used by the Industrial Technology teacher-education majors (see Appendix N). The passages were each approximately 600 words long. The participants were given two sheets of ruled folder-leaves and only instructed "to write a Summary of the passages." No further instruction was provided. This act was intentionally done.

Both the pre-test and the post-test Summary passages were pre-assessed by the English Language subject matter experts, using a five-point assessment instrument developed in conjunction with the researcher. The scores determined were in respect to (i) the total number of words in the summary, and (ii) the number of main points included. The consensus was that an effective summary should be between 10% - 25% (Milan, 1995; Wiener and Bazerman, 1997) of the length of the original passage (i.e. 60 to 150 words in this case), and should contain only the main points of the passage. Each response was marked 'blindly' once by each rater, and when there were discrepancies in the scores, a third rater was incorporated to break the deadlock. For the purposes of this research, neither grammar, punctuation nor spelling were factored in the final score obtained. Additional descriptive data statistics, that is, a word count and main point(s) count along with the group-mean scores were used to compare the data between the two groups.

Questioning data. Data regarding the Questioning component of the reciprocal teaching procedure were recorded by means of a pre-test and post-test Questioning instrument developed by the researcher. These instruments (see Appendix O) were based on two passages taken from selected textbooks used by the Industrial Technology teacher-education majors.

As part of the pre-testing measure, each participant was given a passage of approximately 600 words with three sheets of ruled paper, and told to 'pretend' that they were a teacher setting a test based on the passage. The number of questions developed, along with the levels of each question, as described by Bloom's Revised Taxonomy (Anderson and Krathwohl, 2001) of the cognitive domain of learning were recorded and analyzed using descriptive statistics, that is, frequency counts and means. The raters were two experienced English Language lecturers from UTech. The raters had previously assisted the researcher in verifying the validity of the Questioning assessment instrument (see Appendix I), and were already competent in its usage.

The Treatment group received instruction on the various types of questions as a part of their intervention. At the end of the study, all participants were given a second passage of approximately 600 words, and again assessed on their ability to generate test items. The number of questions generated, and especially the types of questions posed were again compared

between the Treatment and Control groups, and the data were analyzed using descriptive statistics, that is, the number and types of Questions counted, and the group-mean scores obtained.

Clarification data. In the reciprocal teaching protocol, whenever a participant was uncertain about the use of a word or concept, the participant was encouraged to seek 'Clarification.' Since different participants may need different components of the passages to be clarified, whenever clarification was required, the researcher noted this action. Typically, the needy participant sought assistance from their immediate sub-group members. If this proved unsuccessful in resolving the issue, then anyone from within the Treatment group could be solicited to assist. Failing a satisfactory resolution at this level, the researcher would intervene and suggest how Clarification could be obtained (e.g. via a dictionary, textbook, internet, or from a competent friend, etc.).

Predicting data. The prediction of what information follows a mere segment of an expository passage in a chapter can be quite challenging to determine, and unlike that of a prose passage. Contextual clues, as well as the structure of the chapter or book, can allow predictions to be made. The pre-test and post-test passages used for Summarizing and Questioning were also used for the Predicting component of the reciprocal teaching stratagem. Each respondent was required to predict where the author would go to *immediately* following the given passage. The responses were then ranked into 'weak', 'average', or 'good' categories, and descriptive statistics, frequency counts and group-means applied to the data to compare the Treatment and Control group responses.

Cloze Post-test

The cloze post-test instrument was the same instrument used as the cloze pre-test. The participants were not informed that the same instrument would be used for the post-test. In addition, the time span of nine weeks between test administrations was considered of sufficiently long enough duration that the participants would not remember their exact responses provided in the first administration of the test. Hence, any gain (or loss) scores obtained would represent the participants' reading-comprehension abilities at that point in time, and could be readily determined and compared.

Demographic Data

Typical demographic data were collected using a self-report questionnaire instrument. The participants were asked to furnish their student identification numbers so that they could be paired with a unique five-digit number that would only be available to the researcher, and thus eliminated the need to use names or officially assigned institutional identification numbers on the instruments. Other data collected included their age range, type of high school attended, year of high school graduation, and area of specialization. These data were securely stored in a locked filing cabinet within a locked office. The participants were advised that all data collected would be destroyed within one calendar year after the completion and publication of the findings of the study.

Survey Questionnaires

The demographic data collected were incorporated in one of two questionnaires administered in the combined Treatment and Control group sessions. The Entrance questionnaire was administered during the second session of the study, and sought to capture the habits of each participant at the start of the study, prior to any intervention. Items queried included the number and types of books read recently, participants hobbies, and perceived reading-comprehension ability, and the English Language module registered for (if any) for the current semester.

The Exit questionnaire was virtually a repeat of the entrance instrument. The intent of the researcher was to find out if the intervention had an impact on the Treatment group on factors evaluated at the start of the study, and if the Control group had 'naturally' developed any strategy that had changed their attitudes independently. Both versions of the questionnaire are shown in Appendices K and L.

Focus Group Interview Procedure

A combined focus group interview was conducted with the Treatment and Control groups at the end of the study. It aimed to capture information that might have been missed on the questionnaires, or that needed further probing. A group setting was preferred, as, at this time the participants were familiar with each other. It was hoped that responses from one individual would spur other participants into sharing their experiences and perceptions. The researcher prepared a list of open-ended questions mainly related to the experiences of the Treatment group, and the effectiveness and perceived effectiveness, especially of the Summarizing and Questioning reciprocal teaching components evolving from the research instrumentation. Total participation was encouraged during the session, and the researcher noted the commendations and criticisms regarding the study and its implementation cited by the participants.

Intervention Procedures

Prior to meeting with the potential participants, a formal letter of invitation (see Appendix D) was distributed to all of the registered first-year Industrial Technology teacher-education majors for the 2013/14 academic year. The researcher subsequently visited each of the three Industrial Technology specializations during the first week of classes, and invited them to an "information session" to be held the following Thursday, in the faculty. This session was used to sensitize these prospective participants to the proposed research project. Reminder notices were also placed on the students' notice-boards, stating the specific date, time and venue for the meeting.

In addition to meeting with the Industrial Technology teacher-education majors, the researcher solicited the assistance of faculty colleagues in recruiting 40 non-IT FELS first-year students, as well as 51 non-FELS students from across the remaining Schools, Colleges and Faculties at UTech. This Comparison group received a similar letter of invitation to attend the first session as did the Industrial Technology students.

Session One

The first "information session" was a meeting with all the prospective participants. The co-investigator introduced himself as a lecturer in the Faculty of Education and Liberal Studies, and also as a graduate student of the Virginia Polytechnic Institute and State University (VPISU),

also known as Virginia Tech. (VT), who was in the process of completing a dissertation for the award of a terminal degree. The general purpose of the research was clearly identified, as well as the Institutional Review Board (IRB) requirements of both Virginia Tech. and UTech (i.e. SGSRE) for approval to conduct research that incorporates human subjects.

The potential participants were informed that there would be approximately ten sessions ranging from 45 – 60 minutes in duration, typically once per week at a mutually convenient time, and that one half of them, to be known as the 'Treatment Group', were required to attend all of these sessions during the semester.

The second half, the 'Control Group', were not be required to attend all of the sessions, just the data collection sessions, of which they would be informed of, and that would be held as a combined session with both (i.e. Treatment and Control) groups.

All the FELS Industrial Technology participants in the study were informed that they would be required to take a cloze pre- and post- test (see Appendix F), provide basic demographic data about themselves, and to complete two short researcher-developed entry- and exit-survey questionnaires (see Appendices K and L) among other data collecting instruments. They would also be required to write two summaries (see Appendix N), and to generate questions relating to two given passages (see Appendix O).

In explaining the responsibilities of the potential participants, the co-investigator emphasized the rights of the participants, and described how their confidentiality would be protected. For the purposes of follow-up activities only, the participants would be initially identified by their UTech student identification numbers. Only the co-investigator would have access to their personal information and scores, and that this information would be kept locked away in a secured filing cabinet, in a locked office. They were also informed that all the data retrieved would be completely and permanently destroyed within one year after the satisfactory conclusion of the study and the publication of the results of the study.

The potential participants were also specifically informed that their involvement in this study was not a requirement of UTech, and that their decision to participate or not would not have any bearing on their UTech academic record. Furthermore, any activity scores obtained would have absolutely no impact on their UTech grade-point averages. They were also advised that they had the right to discontinue their participation in the study at any time, without prejudice, although the researcher would like to be informed of their decision and as to why this action was necessary in advance of their discontinuation.

Finally, the prospective participants were informed of the potential personal benefits to be gained by participating in the study, and its potential impact on future programs delivered within the Faculty, and beyond, should any findings suggest that such an action be taken. For the participants who were conveniently assigned to the Control Group, they would have access to the same interventions at a later, mutually convenient date to be decided upon. All of the participants involved in the study were offered access to a summary of the research findings upon request, and open and unlimited access to the completed dissertation. At this point, the co-investigator distributed and read aloud copies of the Informed Consent Form (see Appendix E) to all

participants, with appropriate instructions for its completion and submission. An invitation to participate in the study was extended. The researcher advised the students to read the Consent Form carefully, to contact him directly during the course of the week should they have any questions or concerns, and that the signed forms would be collected the following week during the second session. In order to participate in the study, the volunteers had to first submit the signed Consent Forms. There were no minors included in this study.

Session Two

At the start of the second session, the co-investigator collected the signed Consent Forms from each volunteer present, and commended them for their willingness to participate in the study. The researcher then distributed the researcher-designed Demographic Data collection and Entry Questionnaire instruments (see Appendices G and K), to capture their pertinent personal data. This data included their gender, age range, program specialization, type of school attended, year of High School graduation, and UTech English Language module currently being taken (i.e. Developmental English, Academic Writing 1, or "none").

The entry-survey instrument sought to investigate the existing study habits of the participants. They were asked to respond to questions exploring their module delivery preferences, information regarding any books that they read over the past six months, and the types of any books read (i.e. text-books, novels, etc.). They were questioned on any reading-comprehension assessments that they had participated in previously, and their exposure to any study-strategy programs (e.g. the Readak or SQ3R study systems). The participants were asked specifically whether or not they had ever been assessed for their reading-comprehension skills, and whether or not they had ever received assistance specifically with reading-comprehension strategies. They were also asked to rate themselves with respect to their reading-comprehension abilities, on a scale of 1 – 10, with one being the lowest end of the scale. Finally, the respondents were asked to indicate whether or not they had any prior work-experience, and if so, in what field or discipline it was in.

The participants were given ample time to complete both of the instruments, after which they were returned to the researcher. A register of attendance was taken (as it was for each of the sessions), and the participants were allowed to leave the session.

Session Three

At the start of the third session (as for each session), the co-investigator marked the attendance register, as it was important to monitor the number of sessions that the Treatment group-members participated in. The participants were informed that failure to attend eighty per cent (80%) of the intervention sessions would disqualify a participant from continuing to be involved in the study, as their irregular attendance could affect their performance on the intervention measure, which in turn could skew the data collected. The non-IT and non-FELS (i.e. the Comparison group) participants were thanked in advance for their participation in the study thus far, and informed how they could access the results of the study at the end of the Spring (i.e. Semester 2) Semester.

The cloze pre-test and answer sheets were distributed, and a set of written instructions (see Appendix F) read aloud. The researcher then asked if there were any questions or queries, and

after being satisfied that there were none, the start time of the test was noted, and the participants were advised that they could "begin". The pre-test is not a timed test, and so the participants were allowed to take as much time as they needed to answer as many responses as they were able to. Once the participants felt that they could not answer any further items, and wished to leave, they took both their papers to the researcher, who checked that their unique identification number and group was on both the answer sheet and the cloze test paper, and noted the time on the answer sheet. The participants were allowed to leave the room quietly.

It should be noted that a number of conveniently sampled first-year, FELS non-Industrial Technology majors ($n_{FELS\text{-}non\text{-}IT} = 40$) and non-FELS ($n_{non\text{-}FELS} = 51$) students, where ($n_{FELS\text{-}non\text{-}IT} + n_{non\text{-}FELS} = 91$) from across the campus were also assessed via the cloze pre-test, as a "one-time" comparison assessment. These participants were requested to voluntarily complete the same Informed Consent Forms, cloze pre-test and entry-survey questionnaire instruments (see Appendices E, F and K). They were required to identify their Faculty and School of enrolment. However, they were not asked to identify their names or student identification numbers, neither were they required to attend any additional sessions, nor participate in any post-test activity. They too were given a small incentive of a JA$125 (≈US$1.08) telephone calling card for completing the cloze pre-test.

Session Four

Session four was the final sitting in which an attempt was made to capture comparative, pre-intervention data between the two soon-to-be-formed, Industrial Technology majors' groups (i.e. Treatment and Control groups). All the participants were given a passage of approximately 600 words, taken from one of their required, 'common' text-books (see Appendix N), and three sheets of ruled 'folder leaves'. The participants were required to place their newly coded personal identification numbers and respective specialization groups on the answer sheets. The Flesch Reading Ease, as well as the Flesch-Kincaid Grade Level readability statistics had previously been determined, using Microsoft Word 2007, and found to be 38.4 and 11.7 respectively. The participants were then instructed to read the passage carefully, and to write a Summary of the passage. This was the only instruction given to them. They were not restricted to the length of their summaries, nor limited to the time available to complete the exercise to their satisfaction. However, the total time utilized to complete the activity was recorded for each participant.

In addition to the summary, the participants were asked to generate on a new sheet of paper, as many questions as they could from the given passage. The instruction given required the participants to assume that they were teachers, and that they were required to set a test for their students based on the given passage. This, too, was not a timed activity; however, the total time utilized by each participant for the activity was recorded on the answer sheets for possible further analysis.

The responses to both the summaries and the generated questions were subsequently submitted for assessment by two English Language specialist lecturers from the School of Humanities and Social Sciences (SHSS). The subject matter experts, using the mutually developed and agreed rating instruments (see Appendices H and I) categorized the results. Where there was a lack of consensus between the two raters, a third rater was solicited to break the 'deadlock', thus

providing a degree of inter-rater agreement. The 'Summary' rubric assessed the respondents on i) a word count, and ii) the number of 'main ideas' and 'sub-ideas' included in the summary, as presented in the original passage and determined by the subject matter experts. The 'Questions' rubric assessed the responses in terms of i) the number of questions generated, and ii) the hierarchy of each question posed, according to Bloom's Revised Hierarchical Taxonomy (Anderson and Krathwohl, 2001) of the cognitive domain.

After completing the summary and generating the questions, all the papers were collected and the class-register marked. The session ended and the participants were dismissed.

Session Five

Session five began with the co-investigator marking the register. The researcher then read a prepared list of names of the two assigned groups, that is, the Treatment Group ($n_{Treat} = 19$), and the Control Group ($n_{Cont} = 23$). When assigning the participants to the two groups, no consideration was given to the i) gender, or ii) the specializations of the participants. Based on their cloze pre-test raw scores only, the participants were mechanically paired and then grouped, by means of a colleague randomly tossing a coin, with "heads" signifying the 'Treatment Group'. One member of each pair of participants was *randomly assigned* to the Treatment group. The other member automatically became a member of the complementary 'Control Group'.

At this point, the participants who had been assigned to the Control Group were thanked for their support and willingness to participate in the study thus far. The importance of their role as a comparative group in this 'experiment' was emphasized, and they were assured that they would be called upon again through their group representatives, when it was time to complete the post-test activities. The Control Group was also assured that they would receive the same intervention that the Treatment Group received after the completion of the study, as required by the VT and UTech IRBs, and were reminded that they would receive a summary of the findings upon request, and free and unlimited access to the study once it was completed. The Control Group was then allowed to leave the classroom.

The researcher subsequently addressed the Treatment Group, and asked them not to interact with the Control Group with regards to the study. Failure to observe this constraint would most likely result in the 'contamination' of the study, adversely impacting the results and its findings, and potentially skewing the data set. As a result, there could be absolutely no confidence placed on the validity of the study, which would render the efforts of everyone involved futile.

The researcher reiterated the responsibilities of the participants assigned to the Treatment group. They were asked to attend all of the remaining sessions, and be on time. As an initial icebreaker activity, the group was asked to read a passage of jumbled letters/digits (see Appendix M) projected on the screen. After reading the muddled passage, the group was introduced to a "think-a-loud" type of activity, in which they practiced verbalizing their thought processes while solving given mathematical word and logical problems in teams (see Appendix M). The remainder of the session was used for group member interactions and to practice and reinforce the prepared group-dynamics and 'think-a-loud' type protocols.

Session Six

In this session, the researcher advised the newly formed Treatment group of the objectives of the session, and described the typical structure of expository text, with its paragraph structure, main idea sentence, related sub-ideas, and various advanced organizers. Examples of this structure from selected textbooks were examined, using textbooks provided by the researcher and those that were in the participants' possession. Typical features such as the table of contents, glossary, index, chapter divisions, and section headings and sub-headings were examined. So too were the contextual development of the chapters and paragraphs, the use of pictures, graphics, and tables, as well as presentation styles that incorporated bullets, bold phrases, comments, color, use of space, and learner activities and exercises. The use of examples, worked solutions, and answers to practice problems were discussed, along with how these features and cues are used to guide readers and reinforce their learning as they navigate their way through their expository-style textbooks.

The Treatment participants were divided into five sub-groups of four (4) each, with each member being assigned a title: Summarizer, Questioner, Predictor, or Clarifier respectively. These sub-groupings were retained throughout the remaining duration of the study, as they met at mutually convenient times to be exposed to, and practice the teaching-learning strategies.

The sub-group participants were then introduced to the general concept of Reciprocal Teaching, and its four (4) most frequently employed components. The components were those of writing a Summary of a given passage, writing possible Questions that could be asked by a teacher about a given passage, predicting where the author(s) would take their readers to next as indicated by the contextual clues provided in the passage, and how to obtain Clarification of information that was not readily understood by the readers. To culminate this session, the sub-groups were asked to discuss the features of a textbook by practicing a think-a-loud type protocol which was demonstrated by the researcher, and to predict what they thought would be presented next by the author(s). They were asked to come to a consensus in their deliberations, and to share their opinions with their fellow participants. After a brief discussion and summary of the day's activities, including the importance of non-disclosure with the Control group, the session was dismissed.

Session Seven

For the seventh session, the researcher used a questioning technique to review the activities of the previous session. Once satisfied that the concepts of thinking-a-loud and the use of text-cues found in expository text were familiar with the participants, the researcher reintroduced the four elements of reciprocal teaching to the class. This time, emphasis was focused on the activity of Summarizing. A common passage of approximately 600 words was given to each participant along with three sheets of ruled folder leaves. Each participant was asked to write a Summary of the passage. The summaries were collected by the researcher, to be subsequently graded by the subject matter experts utilizing the agreed Summary grading rubric (see Appendix H).

The researcher then led the class into an examination of the characteristics of a 'good' Summary. The participants were told to identify the main idea of the paragraph/passage, along with any important supplementary idea(s), and to include this information only in their Summaries. Opinions regarding the text should not be included in the Summary. It was recommended to the

participants that a good Summary should only be approximately 10% – 25% (30% maximum) of the original passage, and should include only the main idea(s) of the passage (Milan, 1995; Wiener and Bazerman, 1997). It was also noted that some of the initial Summaries submitted were almost as long as the original document. Good Summaries should be comprehensive, concise, coherent, and in the composers language (i.e. the four C's). The participants were given a common second passage of approximately 500 words to Summarize as a group, being led by the 'summarizer', and practicing the think-a-loud type protocol. The results of these respective Summaries were shared, rated, and discussed with the entire group.

Finally, each participant within a sub-group was given a passage of approximately 450 words to Summarize individually (see Appendix N). Summaries from each of the five sub-groups were taken and group consensus agreed upon as to the quality of each Summary. The participants were requested to recap the key points of the day's session, and were reminded not to divulge the discussions of the session with members of the Control group, after which the session was dismissed.

Session Eight

Session eight began with the researcher using a questioning technique to review the key concepts and practices of the previous session. The participants were given copies of two of the same four passages they used in session seven to practice Summary writing. However, on this occasion, the participants were instructed to 'pretend' that they are teachers setting a test paper, and were to write down "some" test questions based on the passages that they had been given. This was the only information provided to them. After approximately 30 minutes, the researcher then collected the completed test items.

Next, the researcher proceeded to present Bloom's Revised Taxonomy (Anderson and Krathwohl, 2001) of the Cognitive domain of learning to the class. The objectives and rationale of asking Questions at the higher end of the domain were discussed, and examples of higher order questions were both provided and solicited. Using the same passages distributed previously, the groups were then challenged to identify as many higher order cognitive domain Questions as they could. No consideration was given to the weighting of these items, however, even though it is universally accepted that Questions taken from the higher end of the domain are more demanding, and should therefore be awarded more marks than lower-order Questions.

The culminating activity for the remainder of the session centered on a second passage (see Appendix N) given to each group member. They were asked to both write a Summary of the article, and as many higher order Questions as they could. The participants were encouraged to consult with each other should they need any assistance to complete the task. The activities were then collected, and the participants asked to recap what they had learned during the session, and to relate it to what they had been practicing since the start of the intervention. They were also reminded not to divulge nor discuss any information about the session with any members of the Control group, and to put into practice during their private studies the strategies presented during the intervention. The session was then ended.

Session Nine

This session started with a quick recap of the two reciprocal teaching strategies presented so far. The participants were each asked to demonstrate verbally to their colleagues the applications of the two skills practiced previously, using available textbooks provided by the researcher.

The researcher then proceeded to review the principal characteristics of expository textbooks that were presented during session six by means of questioning the group. The researcher then lead out in a discussion of how readers could use the features of their textbooks to supplement the basic information embedded in the text. Noting that different authors and publishers had different writing and presentation styles, the participants were asked to specify which features they found most beneficial, and to state why. The participants were then asked how these features could be used to 'Predict' where the author might be leading them to in the text, and what they thought would be presented next. The transitions between paragraphs, sections, and chapters were identified as being most helpful in this regard, and each sub-group was instructed to look out for these transitions, and to pay attention to them as they made their Predictions.

The second activity of this session focused on the 'Clarification' component of the reciprocal teaching strategy. The participants were asked to identify which strategies they employed when, after reading a passage, they did not fully understand what the author was saying in the passage. The need to monitor one's learning, and the awareness of several strategies of how to obtain Clarification regarding information that was not initially apparent led to a lively discussion of the various techniques that the participants practiced, some of which were logically sound, and others ill-advised. The participants were advised to utilize a wide variety of other resources at their disposal, both human (e.g. classmates, lecturers etc.) and non-human (e.g. dictionary's, internet etc.), and to be persistent in their endeavors to obtain new knowledge. The participants were asked to comment on the statement "Persistence is a key virtue of academic success," and were reminded that they could each achieve their ambitions if they worked hard and consistently at accomplishing them.

To culminate the intervention sessions, the participants were asked to verbally recap the four elements of the reciprocal teaching strategy, and state how each component was important in assisting them to comprehend written information. Each sub-group was asked to demonstrate the integration of all four principles as they applied reciprocal teaching to a self-selected passage from their textbooks. The group was then reminded of the cloze post-test during the next session. They were encouraged to be on time, to reflect on and practice all that they had been exposed to over the past nine weeks, and were again asked not to divulge any information with anyone who was not a member of the Treatment group (interaction with Treatment group members was permitted). The session was then dismissed.

Session Ten

At the start of the tenth session, participants from both the Treatment and the Control groups met in the same room at the same time as for the pre-test (i.e. 2:00 p.m.). The co-investigator welcomed the return of the Control group members to the session, and marked the attendance register, as it is important to monitor the number of sessions that the Treatment group-members participated in. Failure to attend eighty per cent (80%) of the intervention sessions would disqualify a Treatment group participant from continuing to be involved in the study, as their

potentially under-par performance, which could, in part, be due to their poor attendance, could skew the data collected.

The cloze post-test and answer sheets were then distributed, and a set of written instructions (see Appendix F) were read aloud. The researcher asked if there were any questions or queries, and after being satisfied that there were none, the start time of the test was noted and the participants were advised that they could "begin". The post-test, like the pre-test, is not a timed test, and so the participants are allowed to take as much time as they needed to answer as many responses as they were able to. Once the participants felt that they could not answer any further items, and wished to leave, they took both their papers to the researcher, who checked that their unique identification number and group were on both the answer sheet and the cloze test paper, and noted the time on the answer sheet. Upon submission of the post-test instruments, each participant was given a small incentive of a telephone calling-card valued at JA$125.00 (approximately US$1.08) in appreciation of their participation in the study. All the participants were informed that they were to meet for a final session the following week. They were then allowed to leave the room quietly.

Final Session

The eleventh session was not for the purpose of sharing any new information, but was held to collect post-intervention data, and to reflect on the lessons that were learned during the intervention sessions. This session was required since some of the participants had completed their cloze post-test and left the room while others continued to work. It was not feasible to reconvene the session after the last participant had completed the post-test.

The participants from both the Treatment and Control groups met together and completed a 'Summary' of a given passage of an approximately 500 word (see Appendix Q). They were then asked to identify 'Questions' that a teacher could set on a 'test' of the passage, and were asked to 'Predict' where they anticipated the passage would proceed to next. The participants were also asked to specify any information that they perceived they needed to 'Clarify' further, or were not absolutely clear about. These responses were collected and were subsequently analyzed according to the participants' group, that is, Treatment or Control.

After a short break during which light refreshments were served, all of the participants completed an Exit Survey instrument (see Appendix L). The Treatment group then shared with the Control group what they had gathered from participating in the intervention over the previous six sessions. This activity resulted in a focus group interview, in which the Treatment group members expressed their likes and dislikes of the weekly interventions, what they thought should be expanded or eliminated, and how they thought they had benefitted from their involvement in the study. The Control group members were permitted to ask questions of the Treatment group members at this time.

The researcher then thanked all of the participants warmly for their involvement in the study, and assured them that they would be notified once the study was completed, as to how they could access a summary of the results of the study, should they so desire to obtain a copy of it. Arrangements were also made with the Control group members as to when they could meet with the researcher to be exposed to the reciprocal teaching strategy. It was decided that the earliest

mutually convenient time would be after their last end-of-semester examination during the final examinations week. The data collection sessions had come to an end.

Data Analysis Procedures

The first two tests to be conducted on the data set utilized the SPSS (v16) and JMP Pro 11 statistical analyses programs on the computer. The researcher investigated the appropriateness of the use of parametric along with non-parametric statistical analysis techniques by conducting i) the Kolmogorov-Smirnov test to determine if the data were from a normally distributed set of scores ($\rho < .05$). In addition, the researcher conducted ii) the Levene's test for homogeneity (i.e. equality) of the variances to see if the variances between the Treatment and the Control group-mean scores can be assumed to be equal at the $\rho < .05$ level.

Despite the fact that the participants in this study were not randomly selected (nor assigned), and neither were there 30 participants per group (i.e. Treatment or Control), the data sets were pooled and checked to see if they met the necessary criteria to apply parametric test analyses. If *either* of the above mentioned test results rejected their respective null hypotheses, that i) the distribution of the cloze pre-test scores were normally distributed, and ii) the variances of the group-mean scores of the two groups (Treatment and Control) were similar, then the researcher was constrained to employ non-parametric analytical tools only throughout the analyses of the study. Should the analyses of the results suggest that the researcher should fail to reject *both* null hypotheses, the criterion for applying parametric analyses would have been satisfied, and the researcher will report the parametric (i.e. stronger) test results only. However, the researcher will follow the recommendation of Fraenkel and Wallen (2000), and analyze the data set using both the parametric and non-parametric techniques, and report both values should a variance occur between the results.

In addition, the data set was investigated descriptively, using the SPSS (v16) and JMP Pro 11 programs. The results were reported in tabular and graphical forms, and included the use of line-graphs, bar-, box-, and scatter-plots, indicating any outliers should any occur.

Analyses of Research Questions

In order to address the research questions, the data were analyzed so as to yield pertinent information. All data collected were analyzed to cumulatively answer the research questions using a combination of descriptive and inferential statistics where applicable. For the inferential statistics, the predetermined alpha values of 5% or less (i.e. $\alpha = p \leq .05$), and one-tailed tests were used extensively throughout the study. The analyses of the research questions were addressed by analyzing each of the research questions as follows:

1. Does the reciprocal teaching method improve reading-comprehension among first-year Industrial Technology teacher-education majors at UTech?

In order to address Research Question 1 five null hypotheses (H_o 1a, 1b, 1c, 1d, and 1e) were investigated, that i) there would be a statistically significant difference between the group-mean cloze pre-test scores of the Treatment and Control groups, ii) and iii) the group-mean post-test scores would be statistically different then their pre-test scores for both the Treatment and the Control groups, iv) there would be no statistically significant difference between the group-mean

cloze post-test scores of the Treatment and the Control groups, and v) that the individual post-test scores would be less than their corresponding pre-test scores for the Treatment group members.

Null Hypothesis 1 (H_o 1a) sought to determine whether the Treatment and Control groups were 'equivalent' in terms of their reading-comprehension levels at the onset of the study. It was hypothesized (H_1 1a) that these two groups would perform equally well on the cloze pre-test. Using the non-parametric Mann-Whitney test and its parametric equivalent, the two-sample *t*-test (unrelated, two-tailed test, $p < 0.05$ significance level), this null hypothesis suggested the statistical significance of the two group-mean pre-test scores.

Ho 1a: $\mu_{Treat} \neq \mu_{Cont}$ (Pre-test scores)

Null Hypothesis 2 (H_o 1b) was appraised by way of testing the group-mean gain-score (i.e. post-test – pre-test scores) using the non-parametric Wilcoxon Signed Rank test (equivalent to the parametric Student's *t*-test (related), $p < .05$, single-tailed test) for the Treatment group. It was hypothesized (H_1 1b) that the Treatment groups' group-mean post-test score would significantly exceed its group-mean pre-test score. To reject this null hypothesis (H_o 1b) would imply that the Treatment group significantly improved its mean reading-comprehension (i.e. Post-test) score over the duration of the study. It was anticipated that this should be the case of the Treatment group, but not that of the Control group. Stated mathematically:

H_o 1b: $\mu_{Post\text{-}test} \leq \mu_{Pre\text{-}test}$ (Treatment group)

Likewise, Null Hypothesis 3 (H_o 1c) was evaluated by way of testing the group-mean gain-score (i.e. post-test – pre-test scores) using the non-parametric Wilcoxon Signed Rank test (equivalent to the parametric Student's *t*-test (related), $p < .05$, single-tailed test) for the Control group. It was hypothesized (H_1 1c) that the Control groups' group-mean post-test score would significantly exceed its group-mean pre-test score. To reject this null hypothesis (H_o 1b) would imply that the Control groups' pre-test score did not significantly outperform its post-test score over the duration of the study. Stated mathematically:

H_o 1c: $\mu_{Post\text{-}test} \leq \mu_{Pre\text{-}test}$ (Control group)

Null Hypothesis 4 (H_o 1d) compared the group-mean post-test scores of the Treatment and the Control groups. The Mann-Whitney (*U*) test (equivalent to the parametric Student's *t*-test (unrelated), $p < .05$, single-tailed test) was used to determine if the group-mean post-test scores between the two groups were statistically different. To reject this hypothesis would imply that one group was able to improve its gain-score more significantly than the other was. It was anticipated that the Treatment group would obtain the larger gain post-test score of the two groups. Stated mathematically:

H_o 1d: $\mu_{Treat} = \mu_{Cont}$ (Post-test scores)

The fifth null hypothesis (Ho 1e) was conducted at the individual level. Members of the Treatment group who received the reciprocal teaching intervention were analyzed via the use of

a paired *t*-test, to determine whether their individual gain scores (i.e. post-test – pre-test) are statistically significant. The alternate hypothesis (H_1 1e) stated that, for the Treatment group, their individual post-test scores would significantly exceed their pre-test scores. This within group analysis is a powerful indicator of the impact of the intervention. Stated mathematically:

Ho 1e: $\mu_{\text{Post-test}} \leq \mu_{\text{Pre-test}}$ (Individual Treatment group members)

To infer the statistical significance of changes between and within the Treatment and Control groups on the reading-comprehension variable, the non-parametric Wilcoxon Matched-Pairs Signed Rank Test (*Z*-value, equivalent to the Student's *t*-test (related), and the Mann-Whitney (*U*) test, equivalent to the *t*-test (unrelated) respectively) were reported on the cloze pre-test and post-test differences (i.e. gain-scores). However, the Wilcoxon and Mann-Whitney tests, which do not make the assumptions upon which parametric tests are based, were initially assumed to be the most appropriate of the two tests (until after the data was analyzed for normality and homogeneity of variances, and which, if determined to be satisfactory, permitted the use of the more robust, preferred parametric analysis techniques), as the small group sizes used cannot be assumed to be normally distributed, nor were all its members randomly selected and assigned.

In addition to the quantitative pre- and post-test scores, supplemental descriptive data were collected via the self-report instruments, questionnaires, and the four pre- and post-test reciprocal teaching sub-component scores of bot the Treatment and Control groups. These results were compared and contrasted, and the findings interpreted and noted by way of tables, graphs and comments to provide a richer interpretation of the impact of the reciprocal teaching methodology. The participants of the Treatment, Control, and Comparison groups were contrasted on i) the average number of correct responses made, ii) the average number of incorrect responses made, iii) the average number of blank items (i.e. no attempt made to respond), iv) the number of supplemental marks made, and v) the average time taken to complete these 'unlimited time' tests in an attempt to develop a 'profile' of the respective groups.

2. What reading-comprehension levels are characteristic of first-year Industrial Technology teacher-education majors at UTech?

Research Question 2 was answered in two parts, by means of descriptive measures, and a statistical test for significance differences. The reading-comprehension level of each participant in the study was determined by means of a researcher–developed cloze-type pre-test instrument. Neither the cloze pre-test nor post-test were administered as a timed test. However, the time taken to complete each test, along with the total number of 'acceptable' correct responses, incorrect responses, and unanswered responses were recorded. The raw score (i.e. number of correct items) obtained by each participant on the pre-test during the third session was then categorized into one of the three reading levels defined by Gillett and Temple (1990), being ranked by the comparable methods of Bormuth (1968) and Rankin and Culhane (1969). The predetermined reading-comprehension level scores used per ranking are (i) independent level ($\geq$ 50%), (ii) instructional level (39% – 49%), or (iii) frustration level ($\leq$ 38%). Observations were then made regarding the findings, which included comparing the group-mean scores and the frequency counts per reading level category for all of the FELS Industrial Technology, FELS non-Industrial Technology, and non-FELS participants. Additional comparisons were conducted

by contrasting both the FELS-Industrial Technology versus the FELS-non-Industrial Technology participants, as well as the FELS (Industrial Technology + non-Industrial Technology) participants with respect to the non-FELS sampling. These data were captured descriptively in both tabular and graphical forms, and reported as expectancy tables.

The statistical component to Research Question 2 utilized a one-way analysis of variance (ANOVA) F-test (unrelated), applied to the three groups investigated, that is, the FELS-IT, the FELS-non-IT, and the non-FELS groups. It was hypothesized that at least one of these three groups would differ significantly (i.e. is statistically different) or is not significantly equivalent to the others when their group-mean pre-test scores were investigated. The one-way ANOVA examines all three groups simultaneously for equivalence with respect to their reading-comprehension levels, and is a between groups measure. Null hypothesis (H_o 2) examines whether the group-mean reading-comprehension scores of all three groups are statistically equivalent. Stated mathematically:

H_0 2: $\mu_{FELS\text{-}IT} = \mu_{FELS\text{-}non\text{-}IT} = \mu_{non\text{-}FELS}$ (Pre-test Group-mean scores)

3. What are UTech Industrial Technology teacher-education majors' perceptions of the strengths, weaknesses, and effectiveness of the Questioning and Summarizing reciprocal teaching intervention sub-strategies?

Pre- and post-test data were captured on two of the four sub-components of the reciprocal teaching intervention (i.e. Summarizing and Questioning) from both the Treatment and Control groups, even though the Control group did not benefit from the reciprocal teaching intervention. Statistical analyses were conducted on the self-reported mean gain-scores of each sub-component for the Treatment and Control groups independently, by means of the Wilcoxon Signed Rank test (equivalent to the parametric Student's *t*-test (related), $p < .05$, one-tailed test). This statistic is a measure of the demonstrated effectiveness of each sub-component for the Treatment group, and a measure of the perceptions of the Control group (i.e. within each group). The sub-components were then ranked for each group by the researcher in their order of statistical significance, from most to least significance.

In addition, the Treatment group was specifically asked to rank their perceptions of each of the four sub-components of the reciprocal teaching intervention, which was coded, weighted, and contrasted with the statistical findings, to see if there was any rank disparity between the researchers' observations and the participant's perceptions.

For each sub-component, a Mann-Whitney (*U*) test (equivalent to the parametric Students t-test (unrelated), $p < .05$, one-tailed test) was conducted on the Treatment and Control groups on their perceived group-mean gain-scores. This statistic allowed the researcher to contrast the perceived effectiveness of each sub-component between the two groups.

The nature of this 'perceived effectiveness' question necessitated a descriptive-type effort, with its richer and deeper understanding of the issue at hand (Leedy and Ormrod, 2001). To this end, Research Question 3 was directly addressed by the participants of the Treatment group via a self-reported assessment on the effect of the reciprocal teaching intervention on them. Additional

data, taken partly from the entrance and especially from the exit questionnaire instruments, generated questions that could be further explored during the focus-group interview session, and were evaluated using descriptive statistical methods (e.g. frequency counts). The participants were encouraged to speak openly about their experiences with the reciprocal teaching methodology, and asked how they expected to benefit from the exposure. The researcher noted their responses, and interpreted and reported the comments and findings accordingly.

Information regarding the perceived benefits of each of the four sub-components of the reciprocal teaching methodology was collected from the Treatment group by means of the self-reported exit questionnaire, and the open-ended questions that they generated in the focus-group interview session. These descriptive data were coded and analyzed for recurrent themes and the positive or negative perceptions of the participants noted for each respective sub-component. The researcher then used the data collected to rank each of the four reciprocal teaching sub-strategies according to their perceived ratings.

A check of the mean-gain scores (i.e. post-test – pre-test scores) for each sub-strategy was made to determine which of the four sub-strategies produced the highest mean-gain score. This score was then "descriptively" compared and interpreted with the perceived benefit ratings of the participants to see if they are similar in temperament, as the sub-component having the largest perceived benefit might not have yielded the largest mean-gain-score.

Ethical Implications of the Study

Throughout the duration of this study, the sensitive nature of the privacy concerns of the participants was of paramount importance. Before any research data were collected, approval to conduct the study was obtained from the Virginia Polytechnic Institute and State University's (VPISU) Institutional Review Board (IRB). This study is classified under the 'exempt' status by the IRB. Furthermore, since the research data were being collected at the main campus of the University of Technology, Jamaica, permission to conduct the study there was also solicited from the School of Graduate Studies, Research and Entrepreneurship (SGSRE) at UTech. For copies of the letters of authorization to proceed with the collection of data see Appendix B.

The researcher designed the study so that the participants were protected against undue exposure to psychological harm, such as stress, embarrassment, or loss of self-esteem. The researcher met with the then prospective participants, informed them of the purposes and nature of the study, along with its potential benefits and importance, and entertained all related questions and concerns. The prospective participants were each given copies of the Consent Form (see Appendix C) and given one week to review it, to seek clarification if necessary, and to sign and return the form if they consented to participate in the study. They were specifically informed that their performance in this study was unrelated to their UTech program of study, and that they had the right to withdraw at any time without prejudice, as participation in the study, although extremely desirable on the part of the researcher, was strictly voluntary.

Participants in the study did not use their names or UTech student identification numbers for identification purposes. Instead, they used a unique and confidential form of the last four digits of their student identification numbers in reversed order and modified so as to make it virtually untraceable, in order to improve the confidentiality of the study. In addition, no information

pertaining to individual participants was shared with anyone, and only data related to the study were collected. The data were accessible only by the researcher, and were kept in a locked filing cabinet in a locked office. Finally, the researcher ensured that the shared report on the findings of the study was complete, accurate, and without any misrepresentation, and that this data could not be traced to any individual participant.

Summary

This chapter presented a description of the major considerations and procedures that were followed while conducting this study. It incorporated the Evaluation Standards used to determine the worth of an evaluation study, along with validity and reliability issues for experimental/quasi-experimental research, an in-depth description of the participants of the study, as well as an outline of the data collection and analyses methods. This information is necessary, as the researchers' (i.e. VPISU) doctoral, and the IRB and SGSRE ethics committees must be assured that there will be no physical or psychological harm done to any participant during the course of the research. In addition, critics and evaluators of the study need to be able to verify the validity of the research methodology to determine the degree of confidence to be placed on the research findings, and its applicability to other comparable situations and populations. Finally, detailed information is provided should there be a desire to subsequently replicate the study by another researcher.

CHAPTER IV
RESULTS OF THE STUDY

The primary findings of this study are predicated on the formation and analyses of the responses to the research instrumentation of the first-year (i.e. freshman) Industrial Technology (IT) teacher-education majors ($n_{FELS\text{-}IT} = 42$) enrolled in the Faculty of Education and Liberal Studies (FELS) at the University of Technology, Jamaica (UTech), during the 2013-2014 academic year. This group was further sub-divided into a Treatment ($n_{Treat} = 19$) group and a Control ($n_{Cont} = 23$) group for the purpose of conducting the quasi-experimental study. Two additional comparison groups, a FELS non-Industrial Technology ($n_{FELS\text{-}non\text{-}IT} = 40$) teacher-education majors' group, and a non-FELS ($n_{non\text{-}FELS} = 51$) group (both comprised of students conveniently sampled from across the faculty and extended institution respectively), were also included in the analysis for comparative purposes in the investigation.

Throughout the study, it was assumed that voluntary responses, and even the performances of the participants on the data collection instruments, were completely honest, accurate, and representative of typical participants, and as such, were useful for analysis and comparative purposes. Much of the supplemental descriptive data collected was in the form of self-reports obtained from the participants. This information was included in the study in an effort to develop a profile of the typical student currently enrolled in the FELS teacher-education program. Such information may be used to aid in determining the appropriateness of any future implementation of the reciprocal teaching strategies as a generalized teaching strategy within the institution, and in the FELS Industrial Technology program in particular. However, it should be noted that self-perceptions and reports have significant implications on the validity, and even the reliability of any study. Therefore, the primary research question was addressed independently of any self-report responses.

In conducting the investigation, it was necessary to depart from the original researcher-proposed design of comparing two mechanically matched groups, matched primarily on their researcher-developed cloze instrument pre-test scores. As far as it was feasible, the researcher intended to also match the Treatment and Control groups not only on their cloze pre-test scores, but also by gender, age-grouping, school-type attended, and English Language modules for which they were currently registered. After being so 'matched,' the primary research question would be examined by statistically analyzing participant Treatment and Control group scores on cloze instruments in pre- and post-tests for reading-comprehension.

After formation of the Treatment and Control groups, six of the volunteers from the Treatment were group were either unwilling or unable to make the commitment to meet regularly at the most suitable day and time, on a Thursday at 2:00 p.m. This occurrence resulted in the researcher having to replace those participants with their corresponding 'matched' partners where possible, or to replace them with willing participants from the Control group with comparable cloze pre-test scores. This measure accounted for a statistically significant difference between the group-mean pre-test scores of the Treatment and Control groups.

Furthermore, six of the first-year FELS Industrial Technology students who initially volunteered for the study did not complete the academic year, four from the Treatment group, and two from the Control group. This is a somewhat typical occurrence in the teacher-education program (i.e.

student academic mortality). Therefore, the researcher had to conduct the study using only the available and willing first-year teacher-education participants, a slight departure from the original percentage participation intended, but not an insurmountable situation.

Analysis of the Research Questions

The threefold aim of this study was to determine empirically: (a) an evaluation of the effectiveness of the reciprocal teaching strategy in impacting the reading-comprehension scores of Industrial Technology teacher-education majors at UTech, (b) whether the first-year Industrial Technology teacher-education majors at UTech had any difference in their reading-comprehension level when compared with students enrolled in the other programs and faculties at UTech. That is, one goal was to determine whether or not the Industrial Technology students are statistically significantly "weaker" with respect to reading-comprehension as contrasted with other students at UTech, and (c) an insight into the members of the Treatment group's perceptions of the reciprocal teaching strategy.

To this end, the researcher designed a quasi-experimental study to determine the status of the concerned students (i.e. the FELS-IT students), and to implement the reciprocal teaching strategy to determine its impact on their reading-comprehension scores. Another general intent of this study was to conduct a study that would make it possible to advise the FELS Faculty administration whether or not reciprocal teaching is a useful strategy to include in the curriculum of the Industrial Technology program, based solely on empirical evidence. To this end, the study addressed three research questions, the results of which have been explored individually as follows.

Research Question 1

1. Does the reciprocal teaching method improve reading-comprehension among first-year Industrial Technology teacher-education majors at UTech?

It should be noted that the original intent of the researcher was to administer the cloze-type pre-test to the participants, and then mechanically match the pre-test scores of the FELS Industrial Technology teacher-education majors into two groups. Afterwards, one group would be assigned as the Treatment group, and the other automatically becoming the Control group. This was intended to make the two primary groups of interest 'equivalent' at the onset of the investigation. However, due to the preferences of the participants, and decisions made that were beyond the control of the researcher, there was a slight departure from the proposed design of the study.

Upon the formation of the Treatment and Control groups based on the mechanically matched pre-test scores, two members of the original Treatment group were unwilling to commit to the requirement of meeting for approximately one hour per week for the next eleven weeks. These two individuals requested to be excluded from the Treatment group, and were replaced by two corresponding members of the Control group. An additional four members of the Treatment group were unable to meet during the mutually convenient 'agreed' time in which the remaining Treatment group participants and the researcher could gather. Again, these participants were replaced by four members of the Control group who were willing and able to accommodate the scheduled intervention sessions.

The impact of the unavailability of these six volunteers who would have been in the Treatment group (by sheer chance), although not detrimental to the outcome of the study, resulted in the group-mean pre-test scores of the Treatment and the Control groups not being statistically equivalent, as they would have been if the researcher had been able to maintain the original design of having mechanically matched pairs of participants forming these two groups. The statistical analysis tools applied (i.e. SPSS v16 and JMP Pro 11) accounted for this discrepancy.

Before analyzing the impact, if any, of the reciprocal teaching intervention on the Treatment and Control groups, the researcher established whether or not the two groups were homogenous before the intervention was applied. Afterwards, six statistical tests were conducted on the data set, namely the: i) group-mean pre-test scores of the Treatment versus Control groups, ii) Treatment groups' mean post-test versus pre-test scores (i.e. group mean-gain score), iii) Control groups' mean post-test versus pre-test scores (i.e. group mean-gain score), iv) group-mean post-test scores of the Treatment versus Control groups, v) Treatment groups' post-test versus pre-test individual mean-gain scores, and vi) group-mean pre-test scores of the FELS-IT, FELS-non-IT, and the non-FELS groups. A Normal Quantitative Plot (a graphical check of the normality of the data distribution) was generated for each set of scores, as well as the Shapiro-Wilk Goodness of Fit test (*W*), a numerical method of checking for normality (especially suited for small sample sizes), along with the Levene's (*F*) test (homogeneity of variance assumption) were conducted on the data. The results of these tests indicated that the experimental data were all homogeneous and normally distributed. As a consequence, the researcher was able to rely on the results of the more powerful parametric analyses of the data throughout the data analyses, rather than having to use the non-parametric equivalent tests. The results of the preliminary tests conducted to justify the Treatment and Control groups as being homogeneous are shown in Appendix P.

Table 4-1 shows the percentage Cloze post-test and pre-test scores and their differences for the Treatment and Control groups.

Table 4-1
Cloze Post-Test and Pre-Test Group-Mean Scores for Treatment and Control Groups

	CLOZE-TEST SCORES FOR TREATMENT AND CONTROL GROUPS		
	Post-Test	**Pre-Test**	**Group Difference**
Treatment Group (n_{Treat} = 19)	31.5%	24.58%	6.92%
Control Group (n_{Cont} = 23)	32.0%	30.7%	1.3%
Test Difference	0.5%	6.12%	-

The first statistical examination utilized a two-sample *t*-test (unrelated) to contrast the cloze pre-test group-mean scores of the reformulated Treatment group with the Control group. The researcher hypothesized (i.e. the alternative hypothesis (H_1 1a) that the group-mean pre-test scores of both groups would be equivalent. The two-sample t-test (unrelated, two-tailed test, $p < 0.05$ significance level) was used to examine the null hypothesis (H_0 1a), that the group-mean pre-test scores of the Treatment and Control groups were unequal.

Stated mathematically:

H_0 1a: $\mu_{Treat} \neq \mu_{Cont}$ (Pre-test)

and H_1 1a: $\mu_{Treat} = \mu_{Cont}$ (Pre-test)

The group-mean pre-test score of the Treatment group was 24.58%, and the group-mean pre-test score of the Control group was 30.70%. The difference between these two group-mean pre-test scores was 6.12%, in favor of the Control group. The *t*-statistic was found to be -1.5915, d.f. = 38.733, with a *p*-value of 0.1196, which exceeded the predetermined significance level ($p < 0.05$). It was concluded that there was sufficient evidence to support the null hypothesis (H_0 1a) that the group-mean pre-test scores for the Treatment and the Control groups were statistically different, or unequal. Thus, the null hypothesis (H_0 1a) was accepted; the Control group (30.7%) outperformed the Treatment group (24.58%) at a statistically significant level on the cloze pre-test assessment.

Additional data comparing the cloze pre-test performances of the Treatment and Control groups is shown in Figure 4.1 in the form of a box-plot. A box-plot allows for a graphical representation of the data being contrasted, beyond that of the reported statistical information. By visible comparison, it is seen that the centers (i.e. the bodies) of the box-plots do not approximately line up, with that of the Control group being somewhat above that of the Treatment group. The spreads of the boxes were not equal. Further, the median scores did not line up. Again, the Control groups' pre-test median score was higher than the pre-test median score of the Treatment group. In addition, the top and bottom ends of each body (i.e. boxes) did not approximately align. The lower end represents the 25^{th} percentile score, and the higher end of the box represents the 75^{th} percentile score. Both the 25^{th} and the 75^{th} percentile scores are lower for the Treatment group than the Control group. The lower and upper whiskers of the box-plot shows the minimum and maximum scores attained on either test. As captured, the data shows that the Control group's pre-test minimum score was lower than that of the Treatment group. However, when looking at maximum scores, the Control groups' score was higher than that of the Treatment group. The total range of scores was wider for the Control group than that of the Treatment group. There were no unusual data-points indicated outside of either box-plot.

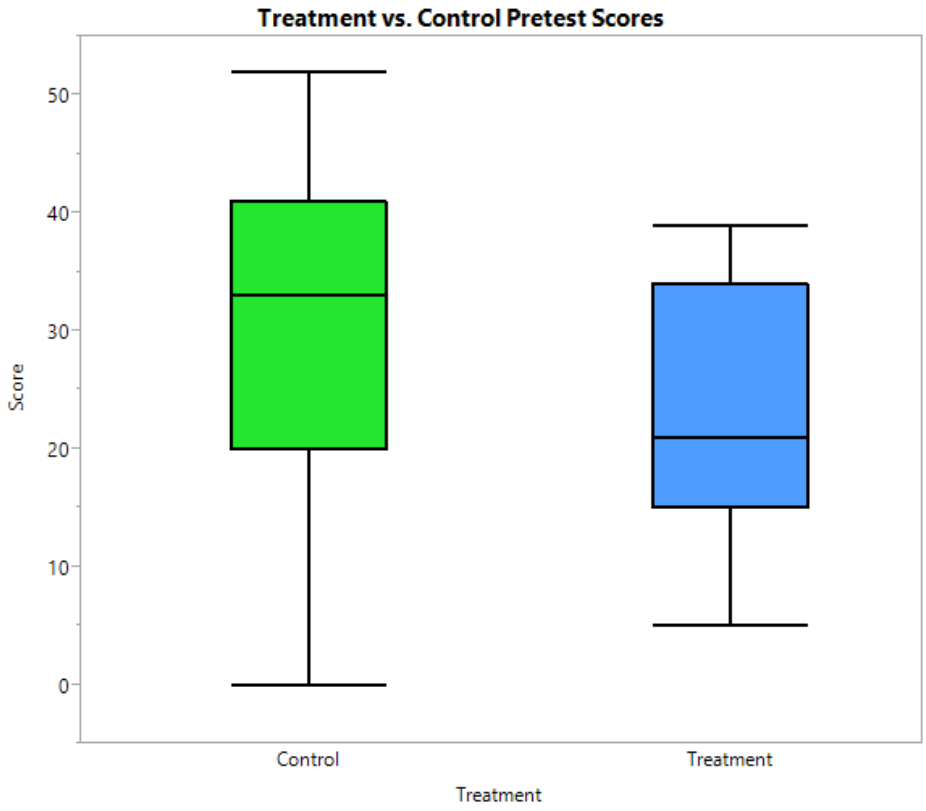

Figure 4.1. A comparison of Box-plots for the Treatment and Control groups' pre-test group-mean scores on the researcher developed cloze tests

Further analysis utilized a two-sample *t*-test (related) to compare the impact, if any, of the reciprocal teaching intervention on the Treatment groups' mean post-test score with respect to its mean pre-test score. For the Treatment group, 19 available post-test raw scores were contrasted with their corresponding pre-test scores (i.e. change scores) for a total of 38 raw scores. These scores were analyzed using SPSS v16 and JMP Pro 11. The group-mean post-test minus the group-mean pre-test score (i.e. group-mean test gain-score) was calculated and found to be 6.92%.

The researcher hypothesized (H_1 1b) that the group-mean post-test score ($\mu_{post\text{-}test}$) would increase in comparison with the group-mean pre-test score ($\mu_{pre\text{-}test}$) for the Treatment group as a direct result of the reciprocal teaching intervention. A null hypothesis (H_0 1b) was formulated that the mean-group post-test score would be less than or equal to the mean-group pre-test score. Stated mathematically:

H_0 1b: $\mu_{Post\text{-}test} \leq \mu_{Pre\text{-}test}$ (Treatment Group)

and H_1 1b: $\mu_{Post\text{-}test} > \mu_{Pre\text{-}test}$ (Treatment Group)

The null hypothesis (H_0 1b), that for the Treatment group, the group-mean post-test score would be less than or equal to that of the group-mean pre-test score, was tested statistically. The test

employed was the two-sample *t*-test (related) between the group-mean pre-test ($\mu_{Pre\text{-}test}$ = 24.58%) and the group-mean post-test ($\mu_{Post\text{-}test}$ = 31.5%) mean gain-scores (i.e. group-mean post-test – group-mean pre-test scores). A *t*-statistic of 2.3258 was obtained, with a *p*-value of 0.0129 (degrees of freedom (d.f.) = 34.71, one-tailed test, at $p < 0.05$ significance level). This statistic indicates that there is sufficient evidence to reject the null hypothesis (H_0 1b), as there is a statistically significant increase in the cloze group-mean post-test score when compared with respect to the cloze group-mean pre-test score for the group that received the reciprocal teaching intervention.

That is to say, the reciprocal teaching intervention had a direct, positive impact on significantly improving the Treatment groups' cloze post-test scores over its pre-test scores. The degree of variability (i.e. central tendency and distributional shape) within a data set is frequently displayed as a "box-plot" (also known as a "Box-and-whiskers plots," Huck, 2000, p.42). The Treatment groups' pre-test and post-test scores are captured graphically in the form of a box-plot and is shown in Figure 4.2. The centers (i.e. the bodies) of the box-plots do not approximately line up, with those of the post-test being somewhat above the pre-test. The spreads of the boxes were not equal, with the spreads of the pre-test scores being the greater of the two. Similarly, the median scores of the ordered scores for each test did not line up. The post-test median scores were higher than the pre-test median scores. Likewise, the ends of the body (i.e. boxes) did not approximately align. The lower end represents the 25^{th} percentile score, and the higher end of the box represents the 75^{th} percentile score. Both the 25^{th} and the 75^{th} percentile scores were lower for the pre-test than post-test scores. The lower and upper whiskers of the box-plot show the minimum and maximum scores attained on either test. As captured, the data show that the pre-test minimum score was less than the post-test minimum score, as is also the case for the maximum scores. The range of scores from minimum to maximum, in both instances is approximately similar between the pre-test and the post-test scores. The range of the post-test scores indicated higher performance. There were no unusual data-points indicated outside of either box-plot.

A general comparative analysis of the of the pre-test and post-test box-plots for the Treatment group suggests that the reciprocal teaching intervention resulted in the 'bunching' and 'rising' of the cloze post-test scores over the pre-test scores.

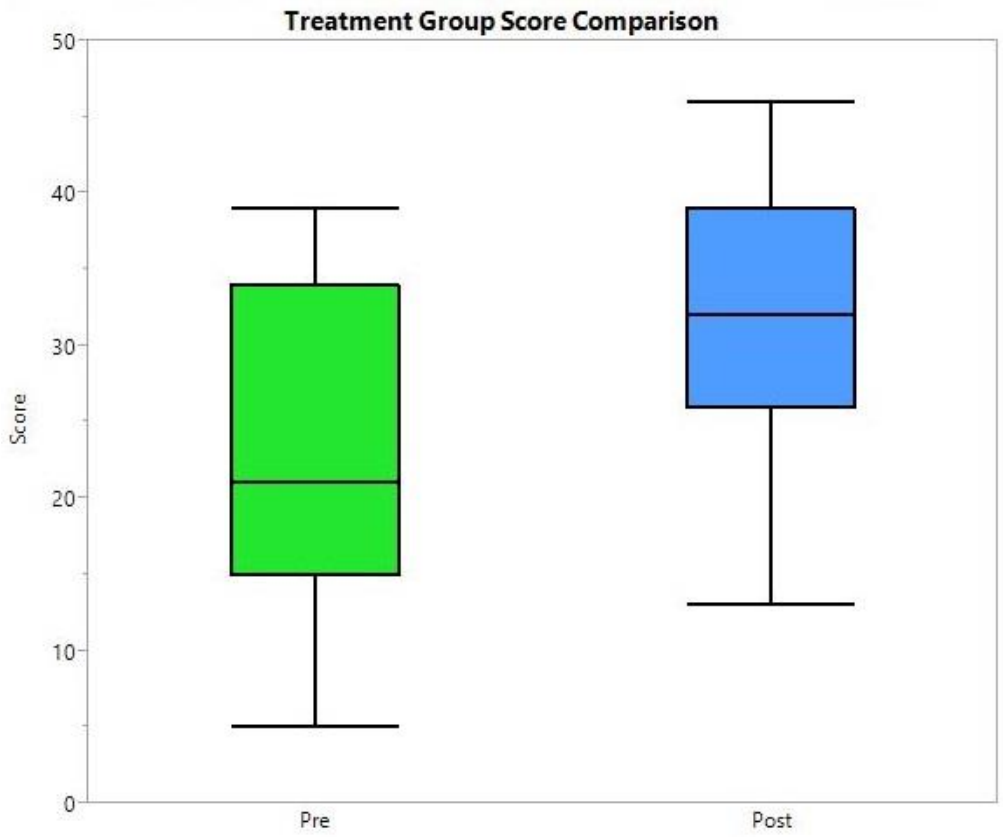

Figure 4.2. A comparison of Box-plots of the Pre-test and Post-test data for the Treatment group on cloze tests.

For the Treatment group, the reciprocal teaching intervention had a positive impact on the reading-comprehension post-test over pre-test (i.e. gain score) performance. The participants benefited from the reciprocal teaching intervention.

The third phase of addressing research question one was to determine whether or not the group-mean post-test score of the Control group was significantly different from its pre-test score. A two-sample *t*-test (related) was utilized for this examination.

The alternative hypothesis (H_1 1c) was that the group-mean post-test score ($\mu_{post\text{-}test}$) would increase significantly with respect to its group-mean pre-test score ($\mu_{pre\text{-}test}$) for the Control group (without the reciprocal teaching intervention). A null hypothesis (H_0 1c) was formulated that the mean-group post-test score would be less than or equal to the mean-group pre-test score for this group of participants, or not statistically significantly greater. Stated mathematically:

H_0 1c: $\mu_{Post\text{-}test} \leq \mu_{Pre\text{-}test}$ (Control Group)

and H_1 1c: $\mu_{Post\text{-}test} > \mu_{Pre\text{-}test}$ (Control Group)

A two-sample *t*-test (related) between these two group-mean test scores was used. Twenty-three pre-test scores and twenty-two post-test scores for a total of 45 test scores were utilized, yielding a total of twenty-two ($n_{Post\text{-}Pre} = 22$) paired available pre-test and post-test scores. These scores were averaged to yield a group-mean pre-test (30.7%) and a group-mean post-test (32.0%) score, which was then analyzed by use of the two-sample *t*-test (related). A *t*-statistic of 0.3286 was obtained, with a *p*-value of 0.3729 (d.f. = 40.17, one-tailed test, at $p < 0.05$ significance level), indicating that there was no statistically significant increase in the cloze group-mean post-test score when compared to the group-mean pre-test score for the Control group. The group-mean gain score for this group represents a practical difference of 1.3% (32.0% – 30.7%) for the post-test over the pre-test scores. However, this difference is not statistically significant. Thus, based on the analysis of the two-sample *t*-test (related), there is insufficient evidence to conclude that the post-test score of the Control group is significantly different from its pre-test score, indicating no statistically significant improvement by the Control group. The null hypothesis (H_0 1c) was therefore retained.

Figure 4.3 shows the box-plots for the cloze Pre-test and Post-test group scores for the Control group. By visible comparison, it is seen that the centers (i.e. the boxes or bodies) of the box-plots approximately line up, with the post-test being somewhat compacted in contrast with the pre-test performance. This similarity in overall performance is quantified from the lack of significance for the two-sample *t*-test analysis discussed previously.

The findings of these analyses strongly suggest that, despite being assessed under similar if not identical conditions, the Treatment and the Control groups performed statistically differently on the cloze-type pre-test instrument.

The Treatment group increased its group-mean post-test score (i.e. gain score) by 6.92 percentage points, which is both practically (6.92% ÷ 1.3% = 5.32 times larger) and statistically significant when compared to the group-mean gain-score of the Control group. The performance of the Treatment group on the cloze post-test, after receiving the reciprocal teaching intervention, improved significantly. This is not to say that every participant in the Treatment group scored higher than every participant in the Control group on the post-test administration. As a group, this improved post-test performance may be attributed to the positive impact of the reciprocal teaching intervention on the Treatment group as a whole.

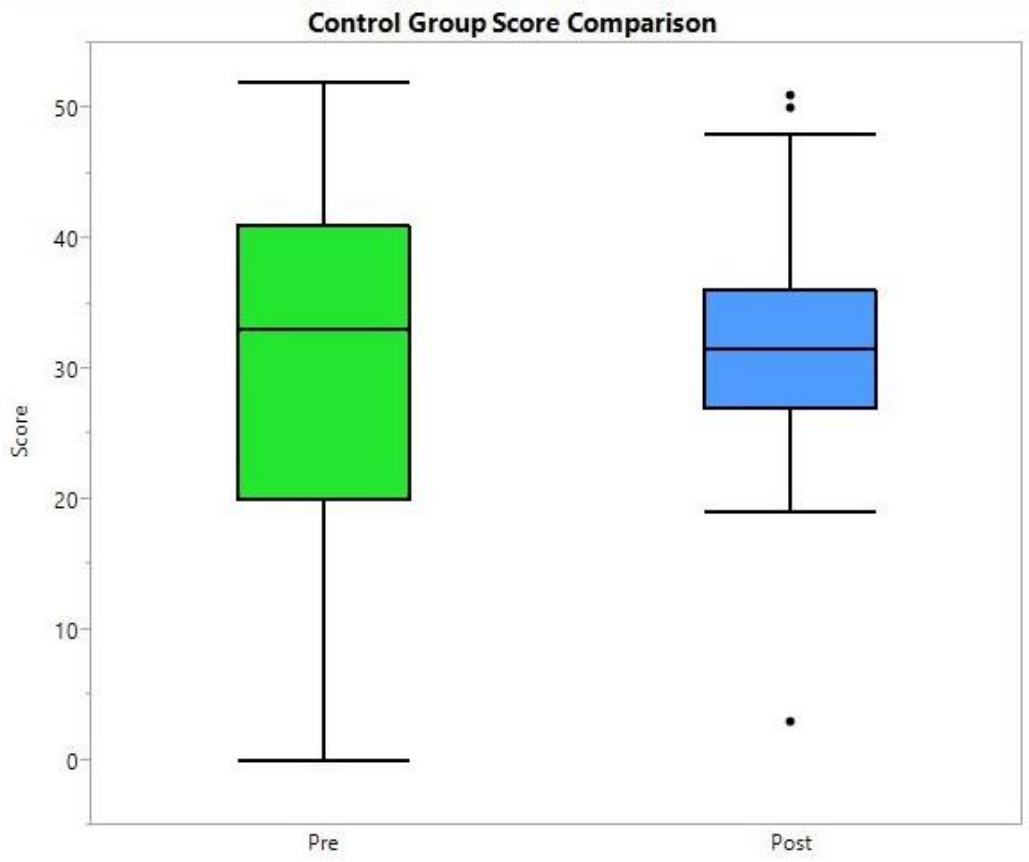

Figure 4.3. A comparison of Box-plots of the Pre-test and Post-test data for the Control group on cloze tests.

Analysis of the pre-test and post-test scores of the Control group suggest that, despite a miniscule difference in the group-mean post-test score over its group-mean pre-test score (i.e. a practical difference), this increase was insufficient to be considered statistically significant. The Control group did not make a statistically significant gain as a group in its post-test group-mean score. This result suggests that it would be wise for UTech to consider changes regarding assessment of the students' reading-comprehension needs, and for providing appropriate interventions on their behalf. Currently, it appears that possible improvements are left, as it were, "to chance."

There was some difference in the spread of the distributions of pre- and post-test scores for the Control group. However, this spread was not significant enough to violate the assumption of constant variance for the two groups, which is an assumption of the two-sample *t*-test (related). There were three data points flagged as potential outliers in the cloze post-test results shown in Figure 4.3. These data points are represented as solid dots in the figure (above the plot). It was determined that these data points did not have a significant effect on the results, so they were left as part of the data set (since there was no justification for their removal).

A fourth analysis was conducted on the post-test group-mean scores of the Treatment and Control groups. It was hypothesized that, as a result of the reciprocal teaching intervention, the

Treatment groups' post-test group-mean score would not be equal to that of the Control group. Stated mathematically, that is:

H_0 1d:	$\mu_{Treat} = \mu_{Cont}$	(Post-test scores)
H_1 1d:	$\mu_{Treat} \neq \mu_{Cont}$	(Post-test scores)

The corresponding null hypothesis (H_0 1d), that neither group would perform significantly differently than the other group, was tested by means of a *t*-test (unrelated). The results obtained were $t = -0.1441$ (d.f. = 38.560, $p = 0.8861$). The interpretation of a negative *t*-statistic indicated that the observed average was below that of the null hypothesis (H_0 1d) mean score. Since *p* (0.8861) is large (i.e. $p > 0.05$), it was concluded that there is insufficient evidence to determine a statistically significant difference between the group-mean post-test scores of the Treatment and Control groups, and that the Control group, with its marginally different score of 32.0%, did not significantly outperform the Treatment group (31.5%) on the cloze post-test. Therefore, the null hypothesis (H_0 1d) was retained.

This critical finding must be interpreted in the context of the two groups' mean pre-test scores, for which the Control group-mean score was 30.70%, and the Treatment group-mean score was 24.58%.

The group-mean post-test scores for the Treatment ($\mu_{Treat} = 31.5\%$) and Control ($\mu_{Cont} = 32.0\%$) groups are similar. When analyzed by means of a two-sample *t*-test (unrelated), no significant difference was noted between them. That is, the difference (or gain) of 0.5% (32.0% – 31.5%) is not statistically significantly different. However, when the group-mean pre-test scores of both groups are taken into consideration (pre-test group-mean scores of $\mu_{Treat} = 24.58\%$ and $\mu_{Control} = 30.7\%$), the group-mean difference (i.e. gain) of 6.12% was found to be significantly statistically different, in favor of the Control group.

Further analyses of the data reflected that, for the Treatment group, its post-test group-mean score improved by 6.92 percentage points over its pre-test group-mean score (i.e. 31.5% – 24.58% = 6.92%), which is statistically significant. For the Control group, the group-mean post-test (32.0%) difference (i.e. gain) score of 1.3 percentage points over its pre-test (30.7%) score is not a statistically significant group-mean gain score. That is, there was no statistically meaningful post-test improvement over its pre-test score for this group.

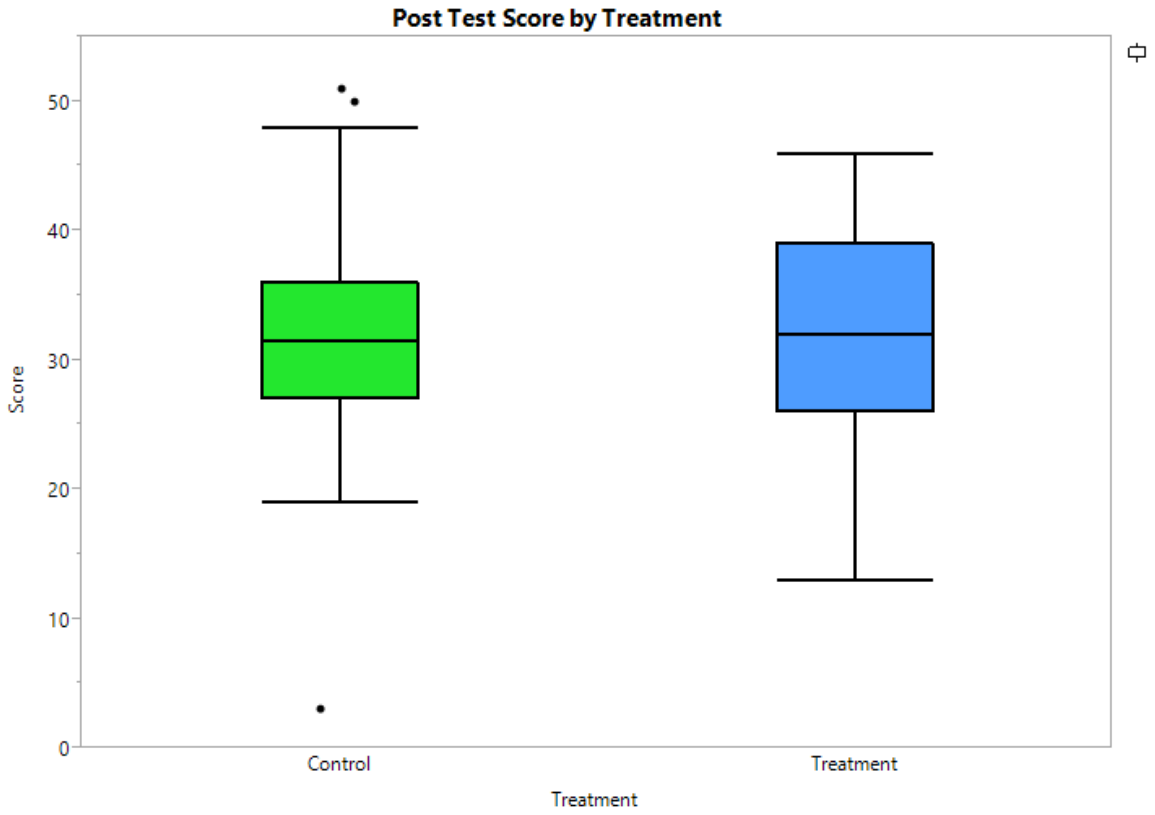

Figure 4.4. Comparison of Box-plots of Post-test Group Scores for Control and Treatment Groups on the cloze test.

The implication of these post-test group-mean gain scores is displayed in the post-test comparison by treatment (i.e. intervention) boxplot (see Figure 4.4). The boxplot reveals visually that there is little difference between the post-test group-mean scores of the Treatment and the Control groups. However, when the pre-test group-mean scores are factored in, because the Control group had a statistically significant (i.e. higher) group-mean pre-test score, the Control group could be considered to be "ahead" of the Treatment group at the on-set of the study. After implementation of the reciprocal teaching intervention, both the Treatment and the Control groups performed at a similar level (i.e. not statistically significantly different). It may therefore be concluded that the effect of the implementation of the reciprocal teaching intervention eliminated the statistically significant pre-test group-mean difference in favor of the Control group, to a "no statistically significant difference" state between the two groups mean post-test scores. Furthermore, this average group-mean gain score for participants in the Treatment group can be considered to be directly attributed to the reciprocal teaching intervention, the differentiating factor between the Treatment and Control groups.

Further investigation into the impact of the reciprocal teaching methodology on the Treatment group was conducted by means of a fifth analysis, a *paired t*-test. As no statistically significant difference was found between the Control groups' pre- and post-test group-gain scores, attention was focused on the Treatment group's pre- and post-test mean-gain scores. For this analysis,

each participant's pre-test score was paired and compared with its corresponding post-test score, allowing for the analysis of the *average individual* gain-scores. This measure was an indication of the impact of the reciprocal teaching methodology on individual members of the Treatment group, comparing pre-test scores with post-test scores.

A paired *t*-test (one-tailed, $p < 0.05$) was used in JMP Pro. 11 to analyze the average individual post-test – pre-test paired gain scores of the Treatment group. There were 18 such paired scores available from this group, whose members were exposed to the reciprocal teaching intervention. It was hypothesized (H_1 1e) that for each individual in the Treatment group, their post-test score would be significantly greater than their pre-test score. The corresponding null hypothesis (H_0 1e) consequently stated that, on average, the post-test scores of each individual in the Treatment group would be less than or equal to their pre-test scores, implying that the intervention did not have an impact on their post-test performances.

Stated mathematically:

H_0 1e: $\mu_{\text{Post-test}} \leq \mu_{\text{Pre-test}}$ (Individual Treatment group members)

and H_1 1e: $\mu_{\text{Post-test}} > \mu_{\text{Pre-test}}$ (Individual Treatment group members)

The results of this analysis indicated that the average difference in test-scores (i.e. post-test – pre-test, or gain score) was 7.83% per individual. Under the null hypothesis (H_0 1e) that the reciprocal teaching intervention would have no effect on the average individuals' post-test scores for the Treatment group, a paired *t*-test statistic of 5.73 was obtained, with a *p*-value of 0.0000123 ($p < 0.05$, two-tailed test). Therefore, H_0 1e was rejected, as there was insufficient evidence to conclude that for the individual group members of the Treatment group, the mean post-test scores were less than or equal to the mean pre-test scores.

The values obtained suggested that the reciprocal teaching intervention had a statistically significant positive effect on the mean-average *individual* post-test scores of the Treatment groups' performance over their pre-test scores, increasing them by an average of 7.83%. Thus the individual members of the Treatment group, on average, significantly improved their post-test cloze scores with respect to their pre-test scores. This result clearly reflected the strength of the reciprocal teaching effect on impacting the reading-comprehension scores at the individual level for the Treatment group.

Research Question 2

2. What reading-comprehension levels are characteristic of first-year Industrial Technology teacher-education majors at UTech?

Research Question 2 was investigated in two measures. The first examined reading-comprehension characteristics of first-year Industrial Technology teacher-education majors after they had been placed into the Treatment and the Control groups. Use of the term "reading-comprehension characteristic" allows for categorization of the participants into one of three reading-comprehension groupings to be defined subsequently. It should again be noted that, due to the unavailability of six of the initial Treatment group selectees, both the Treatment and the Control groups had to be re-formulated to enable a minimum Treatment group size of 20 participants. This figure was subsequently reduced to 19, as an additional Treatment group participant "disqualified" himself by not attending the predetermined minimum of 80% of the intervention sessions. The most noteworthy impact of this revision of the initial research design was that the Treatment and Control group-mean cloze pre-test scores were not numerically equivalent at the onset of the study.

An analysis of the pre-test group-mean scores of the first-year Industrial Technology teacher-education majors was conducted in order to identify the reading-comprehension characteristics of the current students. Of the 48 students enrolled, the researcher obtained usable scores from 42, which represents a student participation rate of approximately 90%. This intake of students is considered to be typical of students who enroll in the Industrial Technology teacher-education program, and therefore was deemed a representative sample to provide typical data to address this research question.

Utilizing the reading-comprehension assessment standards established by Gillett and Temple (1990), the researcher-developed cloze-type instrument pre-test scores were categorized to describe each participants' reading-comprehension level as being either at the Frustration level (0% - 38%), the Instructional level (39% - 49%), or the Independent level (50% and above) (with the pre-determined respective percentage scores indicated in parentheses}. Of the 42 Industrial Technology teacher-education majors from the Faculty of Education and Liberal Studies (FELS), 34 (81%) performed at the Frustration level on the instrumentation used, while 6 (14%) performed at the Instructional level. Two (5%) participants performed at the Independent level. In this way, it was possible to categorize the participants according to their reading-comprehension characteristic levels by means of their cloze pre-test scores, using the researcher-developed cloze-assessment instrument.

Further investigation of the data revealed that, after the final formation into the Treatment and Control groups, where $n_{Treat} = 19$ and $n_{Cont} = 23$, 18 (95%) participants from the Treatment group performed at the Frustration level, compared to 16 (70%) of participants from the Control group. Also, 1 (5%) participant from the Treatment group performed at the Instructional level, compared with 5 (22%) from the Control group. No participant (0%) from the Treatment group performed at the Independent level, whereas 2 (9%) of the participants from the Control group performed at this level. (It should be noted that throughout this study, percentages have been rounded-off to their nearest whole number, where permissible, for ease of representation.)

The pertinent information is captured in the following expectancy tables shown in Tables 1 through 3:

Expectancy Table 1
Reading-Comprehension Characteristics in FELS Industrial Technology Treatment and Control Groups

	READING-COMPREHENSION CHARACTERISTIC			
	Frustration Level	**Instructional Level**	**Independent Level**	**Total**
FELS - Industrial Technology (n_{Treat} = 19)	18 (95%)	1 (5%)	0 (0%)	19 (100%)
FELS - Industrial Technology (n_{Cont} = 23)	16 (69%)	5 (22%)	2 (9%)	23 (100%)
Total	34 (81%)	6 (14%)	2 (5%)	42 (100%)

Expectancy Table 1 notes the reading-comprehension categories in both raw numbers and their respective percentages for the Industrial Technology participants (i.e. Treatment and Control groups) from the Faculty of Education and Liberal Studies.

The second part of the reading-comprehension performance analysis compares the FELS-IT, FELS-non-IT, and the non-FELS groups. Expectancy Table 2 provides comparative analysis of the reading-comprehension characteristics of the total study-population (N = 133) using raw scores and their respective percentages shown in brackets. Among Industrial Technology participants from the Faculty of Education and Liberal Studies ($n_{Industrial\ Technology} = n_{FELS\text{-}IT} = 42$), 34 (81%) performed at the Frustration level, 6 (14%) performed at the Instructional level, and 2 (5%) performed at the Independent level. Of the 40 FELS participants who were pursuing non-Industrial Technology teacher-education licensure, 32 (80%) performed at the Frustration level, 8 (20%) performed at the Instructional level, and none (0%) performed at the Independent level. The table also contrasts 51 first-year participants whose academic major was something other than teacher-education. As a group, 32 (63%) of them performed at the Frustration level, 14 (27%) performed at the Instructional level, and 5 (10%) performed at the Independent level.

Expectancy Table 2
Reading-Comprehension Characteristics of FELS Industrial Technology, FELS Non-Industrial Technology, and Non-FELS Groups.

	READING-COMPREHENSION CHARACTERISTIC			
	Frustration Level	**Instructional Level**	**Independent Level**	**Total**
FELS - Industrial Technology ($n_{FELS\text{-}IT}$ = 42)	34 (81%)	6 (14%)	2 (5%)	42 (100%)
FELS – non-Industrial Technology ($n_{FELS\ non\text{-}IT}$ = 40)	32 (80%)	8 (20%)	0 (0%)	40 (100%)
Non-FELS ($n_{non\text{-}FELS}$ = 51)	32 (63%)	14 (27%)	5 (10%)	51 (100%)
Total	98 (74%)	28 (21%)	7 (5%)	133 (100%)

Expectancy Table 3 contrasts the combined first-year FELS (n_{FELS} = $n_{FELS\text{-}IT}$ (42) + $n_{FELS\text{-}non\text{-}IT}$ (40) = 82), or teacher-education majors, against the conveniently sampled first-year non-FELS ($n_{non\text{-}FELS}$ = 51), or non-Teacher Education majors. Here, it was observed that 66 (50%) of the participants from the Faculty of Education and Liberal Studies performed at the Frustration level, whereas 32 (24%) of the non-FELS participants performed at this level. This combined figure of 98 participants represents 73% of the total population investigated. A further 14 (11%) participants each from both the FELS teacher-education majors and the non-FELS groups, a yield of 28 (21%) performed at the Instructional level. Also two (2%) of the FELS teacher-education majors, and five (4%) of the non-FELS participants performed at the Independent level of reading-comprehension on the specific cloze-type assessment instrument.

Expectancy Table 3
Reading-Comprehension Characteristics of FELS and Non-FELS Groups

	READING-COMPREHENSION CHARACTERISTIC			
	Frustration Level	**Instructional Level**	**Independent Level**	**Total**
FELS Participants ($n_{FELS} = 82$)	66 (81%)	14 (17%)	2 (2%)	82 (100%)
Non-FELS Participants ($n_{non\text{-}FELS} = 51$)	32 (63%)	14 (27%)	5 (10%)	51 (100%)
Total	98 (74%)	28 (21%)	7 (5%)	133 (100%)

A further statistical analytical technique using SPSS v16 and JMP Pro 11 was used to provide additional evidence-based support of the above findings in the form of a one-way ANOVA model analysis. The one-way ANOVA model was utilized to determine whether the three groups' (i.e. FELS-IT, FELS-non-IT, and non-FELS) cloze pre-test scores were statistically significantly different from each other. Assumptions for the one-way ANOVA test, including tests for normality of data (i.e. Shapiro-Wilks test) and constant variance (i.e. Levene's test), were verified in order to ensure the validity of the following statistical analysis. (See Appendix P for further details on these analyses).

In the one-way ANOVA model, the three pre-test group-mean scores were simultaneously analyzed according to group. With sample sizes of FELS-IT ($n_{FELS\text{-}IT} = 42$), FELS non-IT ($n_{FELS\ non\text{-}IT} = 40$), and non-FELS ($n_{non\text{-}FELS} = 51$), group-mean pre-test scores of 27.9%, 29.1%, and 33.1% respectively, were determined. The alternative hypothesis (H_1 2) was formulated that, of the three group-mean pre-test-scores, at least one group-mean pre-test score was not statistically equivalent with respect to the other two scores. Therefore the null hypothesis (H_0 2) was that each of these three group-mean pre-test scores were statistically equivalent. Stated mathematically:

H_0 2: $\mu_{FELS\text{-}IT} = \mu_{FELS\text{-}non\text{-}IT} = \mu_{non\text{-}FELS}$ (Pre-test Group-mean scores)

and H_1 2: $\mu_{FELS\text{-}IT} \neq \mu_{FELS\text{-}non\text{-}IT} \neq \mu_{non\text{-}FELS}$ (Pre-test Group-mean scores)

From the one-way ANOVA test, an *F*-statistic of 2.30 at the $p < 0.05$ level was obtained, with a determined *p*-value of 0.1047, which exceeded the pre-set 0.05 level. This *p*-value strongly suggests that there was no evidence of any statistically significant difference between the performances of these three groups on the cloze pre-test. Thus, there was not enough evidence to reject the null hypothesis (H_0 2) that the three group-mean pre-test scores were indeed statistically equivalent. The three groups performed statistically equivalently on the researcher-

developed cloze pre-test, so the null hypothesis (H_0 2) was not rejected, that is, the null hypothesis (H_0 2) was retained.

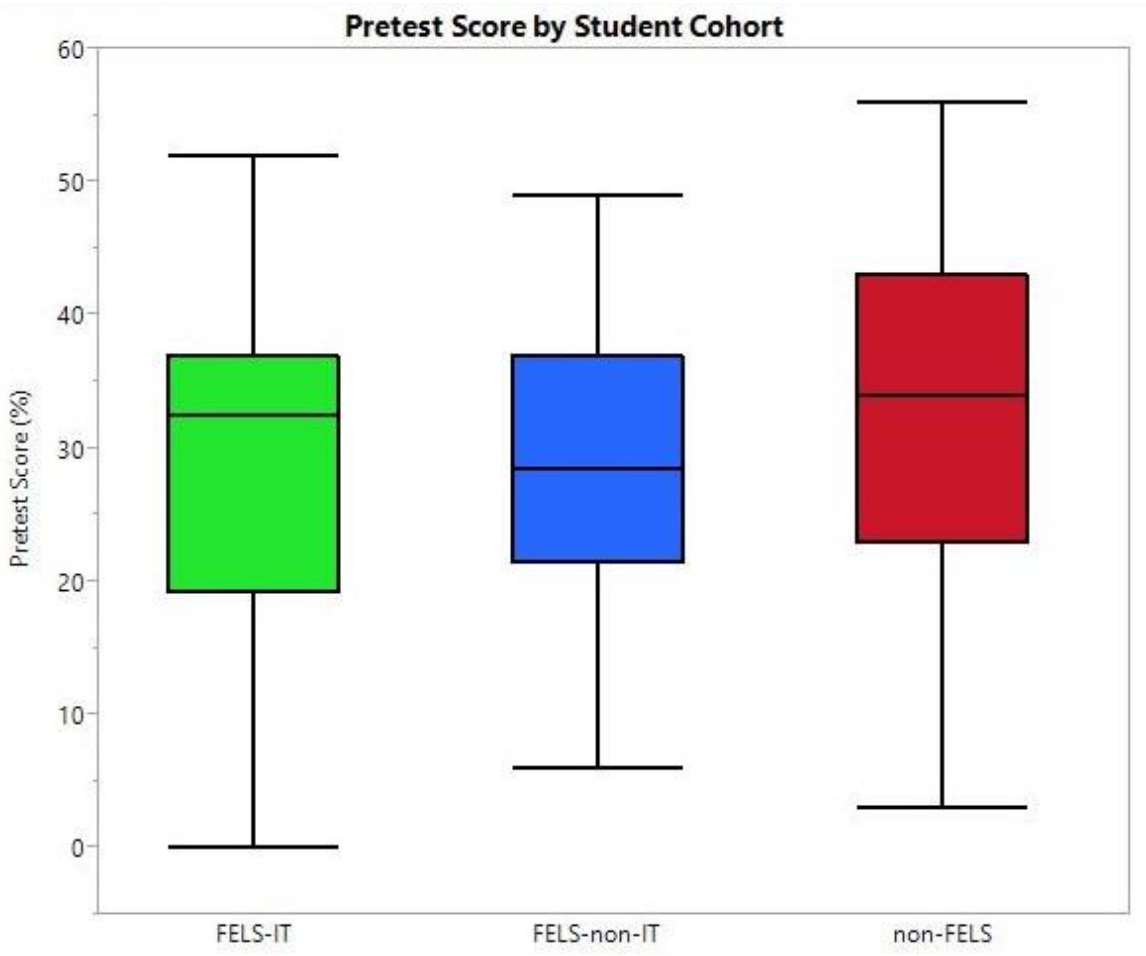

Figure 4.5. A comparison of Box-plots for Pre-test Group Scores in the FELS-IT, FELS-non-IT and non-FELS Groups on the cloze test.

Figure 4.5 shows a comparison of box-plots for the pre-test group scores in the FELS-IT, FELS-non-IT and non-FELS groups. The three cloze pre-test group-score box-plots were contrasted, that of the Faculty of Education and Liberal Studies Industrial Technology teacher-education majors (FELS-IT, $n_{FELS\text{-}IT} = 42$), the Faculty of Education and Liberal Studies non-Industrial Technology teacher-education majors (FELS-non-IT, $n_{FELS\text{-}non\text{-}IT} = 40$), and the non-Faculty of Education and Liberal Studies (i.e. non-teacher education) majors (non-FELS, $n_{non\text{-}FELS} = 51$)..

A visual comparison of the three box-plots indicates that the centers of each box-plot approximately aligned, with the score spread of the non-FELS group being slightly wider than that of the FELS-IT group, which in turn was marginally wider than that of the FELS-non-IT group. The group-*median* score of the non-FELS participants (≈ 33%) was marginally higher than the FELS-IT group (≈ 32%), which in turn was slightly higher than that of the FELS-non-IT group (≈ 28%). The lower-ends of the boxes, the 25th percentile group-mean scores, was lowest

for the FELS-IT group, marginally higher for the FELS-non-IT group, and slightly higher for the non-FELS group. At the upper-ends of the boxes, the 75th percentile group-mean scores, the FELS-IT and the FELS-non-IT scores were approximately equal, with the non-FELS score being higher than the FELS-IT and the FELS-non-IT groups.

The lower- and upper- "whiskers" on the box-plots reflect minimum and maximum percentile scores respectively. The whiskers of both the FELS-IT and the non-FELS groups subsume those of the FELS-non-IT group, with the lowest whisker being that of the FELS-IT group, then that of the non-FELS group, and the FELS-non-IT group being the highest of the three. The upper whisker was highest for the non-FELS group, followed by the FELS-IT group, which was marginally higher than that of the FELS-non-IT group. There are no outliers for any of the three box-plots.

In sum, the data analyzed strongly suggested that there was indeed no statistically significant difference between the FELS-IT, FELS-non-IT, or the non-FELS student groups assessed by their performances on this researcher-developed cloze pre-test instrument. This finding is somewhat contrary to the popular expectations of many individuals, who, without empirical evidence, have long assumed that the FELS Industrial Technology students have unique reading-comprehension challenges.

Research Question 3

Research question 3 allowed for the examination of the descriptive data obtained from the participants who received the reciprocal teaching intervention. Quantitative data made it possible to study the status of the participants on a comparative level; however, it did not take into account the participants' perceptions about the study and how it impacted them. The views of the participants were important in obtaining a fuller, richer description of the reciprocal teaching intervention.

3. What are UTech Industrial Technology teacher-education majors' perceptions of the strengths, weaknesses, and effectiveness of the Questioning and Summarizing reciprocal teaching intervention sub-strategies?

The researcher relied on the Treatment group participants to address research question 3. When asked to rate their reading-comprehension skill-levels after the reciprocal teaching intervention (i.e. post-intervention) the mean-group score was seven (actually 7.25). This was equivalent to the mean pre-intervention score for this group. However, when asked if they had learned anything "useful" or "helpful," the response, "Yes," was unanimous. Seventy percent of the respondents described the reciprocal teaching process as being 'hard.' Others indicated that they liked recording the videos, that reciprocal teaching helped them to read with more understanding, that it helped them to remember what they had read, and that it assisted them to study properly. The participants also indicated that they found the 'ice-breaker' activities to be very nice (*sic*) and "fun". In addition, they described the reciprocal teaching intervention as being very new to them, and "exciting."

Representative comments made by two participants were:

> "It opened my eyes to many techniques used in comprehension."
>
> "Every week I get to engage myself in activities that is (*sic*) helpful for my course of study."

Additional observations submitted by the participants in the Treatment group have been categorized around three dominant themes, namely (a) having a better understanding of how to effectively evaluate expository texts, (b) the impact that reciprocal teaching has had on the participants' performances and their self-perceptions about their reading-comprehension abilities, and (c) their having 'new knowledge' in the form of a strategy to enhance their reading-comprehension skills. Statements expressed included:

(a) Better understanding of how to evaluate expository text:

> "I am better able to understand lengthy readings. I am better able to evaluate."
>
> "…better summarize information, get better clarity, and better understand questions asked."
>
> "… guides you into knowing how to understand what is being read."
>
> "… tells you what to look out for before you start reading."
>
> "How to do a proper summary."

(b) Impact of Reciprocal Teaching on performance and self-perception:

> "I have been performing better in my writing courses as a result of R.T….using strategies such as reading over, questioning, and summarizing give me a better understanding of comprehension."
>
> "…help me to see the importance of scanning a passage in order to make a prediction. I have also put some of these practices in other subject areas and I have gained a positive result."
>
> "I developed the ability to pick out main ideas from a passage in a simple way."
>
> "How to improve my comprehension skills."
>
> "Create and develop reasoning abilities."
>
> "It motivates me."
>
> "It helped me to know about critical thinking and high level questions."

(c) New Knowledge of an effective reading-comprehension strategy:

> "It showed and explained different comprehension techniques that I can apply."
>
> "I learn (*sic*) to read, analyze, and better summarize essays by chunking."
>
> "A lot of things."
>
> "Ways to help you study."
>
> "Easy to apply to any course of study."
>
> "… better answer questions, identify different processes to follow to ensure you reach the correct answers."
>
> "It helps me to use various reading methods to approach any given topic….I have started to question myself and to seek answers. Sometimes I summarize the information read. In addition I pre-read, read then post-read the information."

When asked what they liked the least about the intervention, the participants identified the length of the study (i.e. 11 weeks out of a 16 week semester) and the difficulty of the intervention. Individuals also reported that their group-members were not always cooperative. More than one half of the participants said that the study took up a lot of their time, or that it was very time consuming. However, almost one half of the participants said that the study was "too short."

The participants were asked what they would like to see changed in the study should it be replicated, to which the most common response was "nothing." When the researcher solicited recommendations to improve the study, the responses included: using students' portals to remind them about the intervention sessions and to be on time; having more practice exercises, especially the summary activities for each session; encouraging more students to get involved in the study; and watching more videos about reciprocal teaching. The Treatment group participants also noted that all the students within the university should be allowed to participate in reciprocal teaching activities.

When asked specifically about the perceived strengths of the Questioning component of the intervention strategy, the respondents stated that it guided them to look out for answers to questions, and that providing correct responses to questions was an indication that the reader had fully understood (i.e. comprehended) the passage. One participant even intimated that this activity enabled the teacher to better understand students' comprehension levels.

Perceived weaknesses of Questioning activities included the fact that not asking useful questions might not make it possible for readers to generate the meaningful answers that would clarify the content of the passage, and that the answers to many of the questions might not even be correct. One respondent also suggested that if readers interpreted the "wrong thing" (*sic*) from the topic based on early predictions, it was likely that they would ask the "wrong question," and thus be unable to answer the question asked. This comment reflected the understanding of the participant

that making predictions carefully at the onset was foundational to the process. Generally, among the treatment participants, there was some degree of trepidation about not asking the 'right' question(s) or being unable to answer question(s) asked in a correct and complete manner.

When asked specifically about perceived strengths of the Summarizing component of the intervention, the respondents typically outlined the general guidelines of creating a strong summary, and stated that engagement in the intervention helped them develop the ability to easily identify the main points of a passage. Further, they reported that reducing the length of the passage made it easier for them to understand and to remember it. A noteworthy comment provided was that "being able to breakdown the information into smaller components shows how much understanding is gained by the individual."

The perceived weaknesses of the Summarizing activities included the fact that if the understanding of the passage was inaccurate, the summary will most likely be inaccurate too. Another frequent comment provided was that the first one or two sentences might not provide the main point of the passage, which could lead to an inaccurate summary; thus, it could become necessary to read the passage over and over again to fully comprehend it, which takes up a lot of time (and by implication, effort!). It was also noted that the information may vary from point to point. This statement implies that, based on one's initial prediction, as one reads further into the passage, the reader might have to adjust an initial prediction so as to be compatible with the additional information read.

The researcher sought to determine which Reciprocal Teaching component most likely had the greatest significant impact on the participants' perceived reading-comprehension skills. Participants were asked whether they perceived the Questioning or the Summarizing activities as being most critical to their comprehending a given passage. Responses indicated that 33% of the participants perceived Questioning as being the most critical component to them, whereas 66% perceived Summarizing as being the most critical component to their understanding a given passage.

Finally, the researcher asked the Treatment group participants whether the Reciprocal Teaching intervention had influenced them to change their prior reading habits in any way. The response was an overwhelming "Yes." Their responses included that they are not as fearful of reading long passages any more, and that what they had learned was helping them to comprehend what they were reading. They all agreed that they wished that they had been exposed to the Reciprocal Teaching strategies at an earlier time and were glad that they had agreed to participate in the study.

Summary of Research Findings

Analysis of the research data collected suggests the following pertinent findings:

Research Question 1

1. The group-mean cloze pre-test score of the Control group was significantly different when compared with the pre-test mean-score of the Treatment group.

2. The group-mean cloze post-test score of the Treatment group was significantly different (i.e. a gain-score) over its pre-test group-mean score.

3. At the end of the study, the Control group post-test group-mean score on the researcher-developed cloze instrument showed no statistical significant difference from its pre-test group-mean score.

4. At the end of the study, the group-mean post-test scores on the researcher-developed cloze instrument of both the Treatment and the Control groups showed no statistical significant difference.

   The statement of this finding is most significant, and must be interpreted in light of the fact that on the pre-test assessment, the Control group outperformed the Treatment group on the researcher-developed cloze assessment pre-test. This finding suggests that the Reciprocal Teaching intervention had a positive impact on the Treatment group participants, enabling them to equalize their group-mean score with that of the Control group on the post-test assessment.

5. The mean pre-test to post-test gain scores of the individual Treatment group participants were statistically significantly different.

Research Question 2

6. There was no statistically significant difference between the group-mean scores of the FELS-IT, FELS-non-IT, and the non-FELS groups on the researcher-developed cloze assessment pre-test instrument.

Research Question 3

7. Investigating the perceptions of the Treatment group participants to the Reciprocal Teaching intervention revealed a mainly positive impact of the intervention. It was not assumed that different students with different ability levels were impacted equally. However, the intervention had a statistically significant positive impact on the mean-group and individual reading-comprehension post-test scores. Furthermore, the Reciprocal Teaching strategy was well received by the Treatment group, as the participants had a ‘new,’ positive self-perception about their newly acquired skills, and were exposed to a reputable reading-comprehension strategy which they had never been exposed to before. A popular expression was they wished they had been exposed to this reciprocal teaching strategy before.

CHAPTER V
RESULTS AND CONCLUSIONS

In Jamaica, there is a great need for academia to identify, evaluate, and apply research-driven findings to address local learning problems and challenges that impede personal and professional capacity building. The findings of this Jamaican study on Reciprocal Teaching conducted in a local tertiary institution are quite consistent with those of similar studies conducted by researchers from around the world (Rosenshine and Meister, 1993, 1994). This researcher encourages stakeholders and other investigators to evaluate these findings cautiously, and to determine the extent to which they can be generalized to similar settings in meeting the reading-comprehension needs of other students who depend on expository-type texts to independently acquire information.

Reciprocal Teaching was fancied and investigated by the researcher due to its adaptability, its overall cost-effectiveness, its speed and ease of transferring the requisite skills to instructors and participants alike, and, most significantly, its high rate of, and almost universal claims of success in enhancing reading-comprehension among its practitioners. It is anticipated that the evidence that this study has provided will be adequate to influence the UTech administrators and instructors alike to implement Reciprocal Teaching as a reading-comprehension fostering and monitoring strategy among its students, many of whom are in need of such a learning aid.

Discussion

Reading-comprehension can be a challenging construct to assess accurately and reliably. Measuring reading-comprehension is not a mere mechanical exercise, and its improvement typically takes time and a lot of guided effort on the part of the learner. The post-test assessment employed in this study was conducted after seven weeks of intervention (i.e. strategy introduction and practice). The findings suggest that the intervention had a positive impact on the reading-comprehension skills of the Treatment group, a selection of first-year Industrial Technology teacher-education majors in the Faculty of Education and Liberal Studies at the University of Technology, Jamaica.

Armed with this empirical data, the researcher will propose to the administrators of the faculty and the wider institution that Reciprocal Teaching should be introduced to *all* the first-year students at UTech. This venture can be implemented as a part of the orientation week activities for all new students, with the support and assistance of the staff, prior to the formal start of the academic year. This researcher is of the opinion, based on the evidence and experiences observed during this study, that the impact of such a policy could be observed within one academic year.

When scoring the assessment instruments, the researcher did not accept the use of synonyms as being correct responses, even if the word used made sense contextually. The nature of the cloze test is that a preceding word selection strongly influences any possible subsequent word choice(s). Thus, one incorrect selection can change the entire context of the passage. This action indirectly penalizes more articulate students with wider vocabularies, who often have to choose one word from more options, and are therefore more likely to make an ‘incorrect’ selection. Furthermore, no Jamaican or Caribbean authors were identified with tertiary-level Industrial Technology text-books written with local, and therefore less culture-biased idioms or examples

that could have been used in this study. This represents another need that must be addressed in the short term.

Another observation the researcher found interesting during the course of this study is that most lecturers sampled did not know what the readability scores for their prescribed text-books and handouts are (and in some cases, what readability scores are!). Even more astonishing is the fact that the researcher observed lecturers using text-books at the undergraduate level that they used at the graduate level. It is therefore not surprising that some students, with weak reading-comprehension skills, are unable to independently learn via reading prescribed text-books, and are functioning at the 'frustration' level.

It should be noted too that Reciprocal Teaching is just one of several learning strategies that are potentially designed to improve the learners' reading-comprehension skills. Fellow researchers and practitioners should feel free to compare and contrast the effectiveness of Reciprocal Teaching with other instructional options before determining a strategy to adopt. However, the researcher is of the opinion that the merits and effectiveness of the Reciprocal Teaching strategy will compare very favorably against other options, as demonstrated by this study.

Review of the Major Findings

The quantitative and descriptive measures of reading-comprehension data and participant perceptions were collected by means of researcher-developed cloze assessment and survey instruments. The statistical analyses of the research data collected utilizing JMP Pro 11 and SPSS v16 software suggests the following pertinent findings:

Research Question 1

> Does the reciprocal teaching method improve reading-comprehension among first-year Industrial Technology teacher-education majors at UTech?

The researcher proposed five hypotheses (H_1 1a – H_1 1e) and tested their null hypotheses (H_o 1a – H_o 1e) by means of the statistical analyses software:

H_1 1a: $\mu_{Treat} = \mu_{Cont}$ (Pre-test scores)

On the initial assumption of mechanically matched participants based on their pre-test scores, the researcher hypothesized that the group-mean cloze pre-test scores of the Treatment and Control groups would be statistically equivalent. However, analysis of the data suggested that the group-mean scores were not statistically equivalent, in favor of the Control group. The hypothesis (H_1 1a) was rejected (i.e. H_0 1a was retained).

H_1 1b: $\mu_{post\text{-}test} > \mu_{pre\text{-}test}$ (Treatment Group)

The researcher hypothesized (H_1 1b) that for the Treatment group, the group-mean post-test score would be statistically greater than its group-mean pre-test score. This assumption was found to be the case, and the hypothesis was retained (i.e. H_0 1b was rejected).

H_1 1c: $\mu_{post\text{-}test} > \mu_{pre\text{-}test}$ (Control Group)

The researcher hypothesized (H_1 1c) that for the Control group, the group-mean post-test score would be statistically greater than its group-mean pre-test score. This assumption was not found to be the case, and the hypothesis (H_1 1c) was rejected (i.e. H_0 1c was retained).

H_1 1d: $\mu_{Treat} = \mu_{Cont}$ (Post-test scores)

The researcher hypothesized (H_1 1d) that the group-mean post-test scores on the researcher-developed cloze instrument for both the Treatment and Control groups would be statistically equivalent. After the Reciprocal Teaching intervention, these scores showed no statistically significant difference, and therefore the hypothesis (H_1 1d) was retained (i.e. H_o 1d was rejected).

Properly interpreted, this finding indicates the effectiveness of the Reciprocal Teaching strategy, as at the start of the study there was a statistically significant difference between the Treatment and the Control groups, in favor of the Control group. However, after the intervention, the difference was no longer statistically significant. This finding suggests that the intervention was able to make up for the disparity between the two groups, and place them on par with each other.

H_1 1e: $\mu_{post\text{-}test} > \mu_{pre\text{-}test}$ (individual Treatment group members)

The researcher hypothesized (H_1 1e) that for the Treatment group, the mean pre-test to post-test gain scores of the individual Treatment group participants would be statistically significantly different, that is, the individual gains by the Treatment group participants would be, on the average, statistically significant. When analyzed, this was indeed found to be the case. Thus the hypothesis (H_1 1e) was retained, (i.e. H_0 1e was rejected).

Research Question 2

> What reading-comprehension levels are characteristic of first-year Industrial Technology teacher-education majors at UTech?

At the start of the study, there was no statistically significant difference between the group-mean scores of the FELS-IT, FELS-non-IT, and the non-FELS groups on the researcher-developed cloze assessment pre-test instrument. A high percentage of the participants from each of the three groups (FELS-IT = 81%, FELS-non-IT = 80%, and non-FELS = 63%) for a total of 74% of the 133 participants investigated, were comprehending at the ‘frustration’ level, and only a minute percentage (5%) from the three groups were comprehending at the ‘independent’ level. This strongly suggests the need for a reading-comprehension intervention across the institution.

Research Question 3

> What are UTech Industrial Technology teacher-education majors’ perceptions of the strengths, weaknesses, and effectiveness of the Questioning and Summarizing reciprocal teaching intervention sub-strategies?

Investigating the reported perceptions of the Treatment group participants to the Reciprocal Teaching intervention revealed a mainly positive impression of the intervention. Naturally,

different students with different ability levels were impacted differently. However, the intervention had a positive impact on the group, and was generally well received by all members of the group.

Other Findings

The implementation of the Reciprocal Teaching instructional strategy was a new experience to the researcher. The experience was an enjoyable one, and the researcher intends to continue to use the approach of the Reciprocal Teaching strategy during the delivery of regular reading-intensive lessons. The researcher is of the opinion that the time invested in the instruction and practice of each of the four components of the Reciprocal Teaching strategy used is time well spent. Once the learners have mastered a degree of proficiency of the strategy, they are better able to function independently, and at a faster rate. By improving their reading-comprehension skills, they will actually save time traditionally spent on trying to memorize content read, while improving their comprehension of the textual material covered.

The findings of this study also brought out distinctly to the researcher that the reading-comprehension weaknesses being experienced on the part of the participants is not necessarily solely the fault of the learners, but in part, the failure of their reading-instruction teachers. Reading-instruction teachers often fail to introduce their charges to strategies to enable the learners to decode, comprehend and reproduce effective, efficient and durable reading-comprehension strategies at an early stage of their academic development. Though now much more mature and experienced, none of the tertiary-level participants in the Treatment group professed knowledge or direct instruction in effective reading-comprehension strategies prior to their involvement in this study. This concern needs to be addressed forthwith, and may be readily implemented by exposing these learners to the Reciprocal Teaching strategy.

On a final note, studies typically report on the impact of an intervention on the participants, the intended outcome(s) of the investigation. However, and as a side-note, the researcher wishes to indicate the impact implementing the intervention had on the *researcher*. After more than 20 years of instruction at the tertiary level, the researcher was oblivious to the extent that the instructional style employed was extremely teacher-centered. The general approach was centered around telling the students what to do and how to do it, thereby limiting them from being significantly responsible for, and taking full ownership of their own learning, a more student-centered approach. To this end, the researcher wishes to thank the members of the advisory committee who pointed this out (forcefully), and persisted with the researcher until a noticeable improvement was made in the intervention delivery.

Delimitations

The following were considered delimitations of the investigation:

1. The treatment component of this study was limited by the number of first-year, full-time Industrial Technology teacher-education majors enrolled in the Fall and Spring Semesters of the 2013-2014 academic year at UTech.

2. The small size of the total first-year Industrial Technology cohort (N = 46) prohibited the use of a true experimental-study design, with its random selection and group assignments.

3. Due to limited resources, this study was conducted over a period of approximately 11 weeks, with six direct instructional intervention sessions of approximately 50-60 minutes duration each.

4. No attempt was made to measure the participants with respect to their reading-decoding ability, reading fluency, vocabulary, nor spelling proficiencies.

Educational Implications

After being exposed to approximately six hours of the Reciprocal Teaching strategy, struggling tertiary-level students with 'weak' reading-comprehension skills as measured by the researcher-developed cloze assessment instrument demonstrated statistically significant improved reading-comprehension scores. These participants were exposed to how to think about textual information, to engage colleagues in meaningful discussions about the information read, the characteristics of expository text, how to write effective summaries, and how to ask and identify answers to potential higher-order questions. The findings of the Reciprocal Teaching intervention indicate an increase in their understanding of the textual material that they read, which is consistent with the findings of Palincsar and Brown (1984) and meta-analyses conducted by Rosenshine and Meister (1993 and 1994). Furthermore, Hashey et al. (2003) report that Reciprocal Teaching not only improves reading-comprehension skills, but also the students' self-proclaimed improved self-confidence levels, their understanding of the use of the Reciprocal Teaching instructional strategy, and their increased enjoyment of literature (i.e. reading) in general.

The findings of this study will have educational implications not only on how teacher-education majors at UTech are viewed, but also how students may be trained to improve their reading-comprehension skills. The findings will also have a bearing on whether the administrators at UTech will be willing to implement the Reciprocal Teaching instructional methodology, as recommended, to all of its first-year students or not. In addition, there will be the need to train instructors (i.e. lecturers and possibly teaching-assistants) to effectively deliver the Reciprocal Teaching instructional strategy. Under such circumstances, the trainer(s) must ensure each trainee-instructors is willing and able to become a "guide on the side," and not a "sage on the stage" (King, 1993).

As more and more teachers move towards the use of Educational Technology (e.g. educational videos) in their classes, in part, it is surmised, due to the declining reading- comprehension skills of their learners, it is anticipated that the demonstrated effectiveness of an intervention such as Reciprocal Teaching should result in more teachers implementing additional in-class reading activities and reading assignments to enhance the cognitive effectiveness of their lessons, their comprehension and retention. These can be achieved by employing the use of authentic texts and social-constructivist learning theories, both of which are implicit to Reciprocal Teaching. For most local class-room teachers with a desire to see their students improve, the expectations of the Reciprocal Teaching strategy are 'just what the doctor ordered.'

Future Research and Recommendations

The comparison of the reading-comprehension characteristics between the FELS-IT and FELS-non-IT teacher-education majors with the non-FELS student groups at the start of their academic studies could be repeated at the end of the students fourth year. This assessment could also be conducted at the end of each semester of study, in order to seek to identify possible factors that promote reading-comprehension development. This information could prove useful in identifying at which point(s) the students of the respective programs make the greatest gains in their reading-comprehension development. Their preceding modules could then be analyzed further to determine which module(s) most significantly impacted the student's reading-comprehension, with a view to introducing these principles earlier, and reinforcing them throughout their program of study at UTech.

When scoring the cloze pre- and post- test instruments, the researcher did not accept synonyms as correct responses. The assessment instruments could be re-marked and analyzed, this time accepting the use of synonyms, and the two sets of results could be compared for consistency of findings.

Additional data regarding the number of blanks, inserts, incorrect, and corrected items for each student were collected by the researcher. These data, in conjunction with an evaluation of the quality of each Summary and the Questions generated, could be analyzed to determine if any of these factors could be used to derive a profile of the respondent. For example, if a student makes a correction to a response, is the correction likely to be correct or incorrect? And can the student's reading-comprehension characteristic be determined from the number of corrections made on the answer sheet?

This researcher is a proponent of the Explicit Teaching before Reciprocal Teaching (ET-RT) approach, which was employed in this study. However, the Reciprocal Teaching Only (RTO) approach is an equally valid option available to instructors desirous of implementing Reciprocal Teaching. Jamaican researchers could explore the effectiveness and participants' preference for either of these two approaches to adopting a Reciprocal Teaching strategy locally.

Reciprocal Teaching, as presented in this study, is not a reading-*instruction* strategy, but a reading-comprehension *improvement* strategy. That is, Reciprocal Teaching is most effective when employed by good reading-decoders but poor reading-comprehenders. Due to the fact that many reading-instruction specialists apparently do not consistently teach reading-comprehension strategies to younger students learning to read, additional research could be concentrated on infusing Reciprocal Teaching strategies within the decoding strategies, in an attempt to have younger readers develop decoding and comprehending skills simultaneously. Such research, however, should be only engaged in by certified and experienced reading-specialist teachers.

There is also scope to investigate the more subjective components of students' attitudes and self-perceptions regarding the Reciprocal Teaching strategy, with a view of understanding, from the students' perspective, just how the need for, and the impact of the strategy is perceived, so that the strategy implementation may be improved.

Summary and Conclusions

Academic success among adult-learners at any given tertiary institution such as the University of Technology, Jamaica, is highly dependent on the learners assuming a high level of responsibility for their own learning. As such, 'effective' learners supplement their in-class instruction and widen their conceptualization of any given topic by independent and/or group-work outside of the scheduled learning/practice sessions. A significant portion of these extra-curricular learning experiences expected of tertiary-level learners includes understanding expository texts, which require a level of mastery of advanced reading-comprehension skills, and without which the learner's progress will be impeded. Personal, and indeed professional, national and regional development too, depend on a cadre of efficient and effective life-long learners who acquire, practice, improve-on, and transfer the proper learning of requisite knowledge, skills and attitudes. These 'good' learners must be aware of appropriate learning strategies, as well as when and how to apply them effectively. They also need to know how to proceed whenever they are unsuccessful in attaining their desired learning goals.

This study employed the Reciprocal Teaching (Palincsar and Brown, 1984) strategy to address the matter of reading-comprehension improvement among first-year tertiary-level Industrial Technology teacher-education majors who were average decoders but deemed generally poor reading-comprehenders. Based on the Constructivist approach to learning, and the principles of the Social Development Theory, Reciprocal Teaching resulted in a statistically significant positive change in the pre-test to post-test group-mean reading-comprehension scores of the participants from the Treatment group, as measured by a researcher-developed cloze assessment instrument.

This study, utilizing the Reciprocal Teaching strategy, has provided empirical evidence in support of Reciprocal Teaching being introduced to all UTech students, starting with the first-year students, with a reasonable expectation of attaining improved reading-comprehension skills, and its consequential improved academic achievement, the ultimate goal of any academic institution.

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Appendix A
Rubric to Evaluate Assessment Instruments (Subject Matter Experts)

INSTRUCTION: Kindly read each item carefully and check (√) the response 'No' or 'Yes' as you see fit.

ITEM	DESCRIPTION	NO (√)	YES (√)
1	Is the confidentiality of the participant protected in the design of the instrument?		
2	Is the organizational structure of the instrument logical?		
3	Will the data collected aid in answering the research questions?		
4	Is the data collected by this instrument useful?		
5	Are instructions to the participants clear and easy to understand?		
6	Are the format and design of the instrument clear and appropriate?		
7	Is the font-size suitable for this instrument?		
8	Are the language and readability of the instrument appropriate?		
9	Are the objectives for the instrument specific and relevant?		
10	Is the content covered appropriate and adequate to address the purpose and objectives of the instrument?		
11	Is the printing bold, clear, and appealing to the participants?		
12	Are there any vague or unclear questions in the instrument?		
13	Are the responses suitable and adequate for each question?		
14	Are the scoring procedures clearly indicated for the marker to follow when scoring this instrument?		
15	Will the instrument be easy to administer by the researcher?		
16	Is the administration procedure indicated for this instrument?		
17	Do you approve the use of this data collecting instrument?		

Suggestion(s) for Improvement (if any):

Appendix B
IRB Approval Memo

VirginiaTech

Office of Research Compliance
Institutational Review Board
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, VA 24060
540/231-4606 Fax 540/231-0959
email irb@vt.edu
website http://www.irb.vt.edu

MEMORANDUM

DATE: November 2, 2012

TO: Everton Lewis, Mark E Sanders

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires May 31, 2014)

PROTOCOL TITLE: Reciprocal Teaching as a Reading-Comprehension Fostering Strategy among First-Year Industrial Technology Education Majors at the University of Technology, Jamaica.

IRB NUMBER: **12-903**

Effective October 22, 2012, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As:	**Expedited, under 45 CFR 46.110 category(ies) 7**
Protocol Approval Date:	**October 22, 2012**
Protocol Expiration Date:	**October 21, 2013**
Continuing Review Due Date*:	**October 7, 2013**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

VirginiaTech

Office of Research Compliance
Institutional Review Board
North End Center, Suite 4120, Virginia Tech
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-4606 Fax 540/231-0959
email irb@vt.edu
website http://www.irb.vt.edu

MEMORANDUM

DATE: October 2, 2015

TO: Mark E Sanders, Everton Ray Lewis

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires July 29, 2020)

PROTOCOL TITLE: Reciprocal Teaching as a Reading-Comprehension Fostering Strategy among First-Year Industrial Technology Education Majors at the University of Technology, Jamaica.

IRB NUMBER: **12-903**

Effective October 2, 2015, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the Continuing Review request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As:	**Expedited, under 45 CFR 46.110 category(ies) 7**
Protocol Approval Date:	**October 22, 2015**
Protocol Expiration Date:	**October 21, 2016**
Continuing Review Due Date*:	**October 7, 2016**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

SCHOOL OF GRADUATE STUDIES, RESEARCH AND ENTREPRENEURSHIP
University of Technology, Jamaica

RESEARCH ETHICS COMMITTEE

CLEARANCE CERTIFICATE

REF: **2013/10/SPHHT/04** PROTOCOL NUMBER_____

PROJECT TITLE: *Reciprocal Teaching as a Reading Comprehension Fostering Strategy Among First Year Education Majors at the University of Technology, Jamaica*

INVESTIGATOR/S: **Mr Everton Lewis**

INSTITUTION: UTech, Jamaica DATE CONSIDERED: October 2, 2013

DECISION OF COMMITTEE **Approved**

H. Mayne
Chair, Faculty Ethics Committee. DATE: October 20, 2013

Balford A. Lewis
Chair, University Ethics Committee

University of Technology, Jamaica
Research Ethics Committee
20 OCT 2013
RESEARCH ETHICS COMMITTEE CHAIR

Supervisor(s): **Professor Mark Saunders**, Virginia Polytechnic Institute and State University

==========

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and ONE COPY returned to the Office of Research and Graduate Studies, in .

I/we fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

DATE: _____ SIGNATURE:_____

PROTOCOL NO: _____

PLEASE QUOTE THE REFERENCE NUMBER IN ALL ENQUIRIES

Appendix C
Rubric for Collecting Descriptive data on the perceived effectiveness of the Reciprocal Teaching intervention (Treatment Group)

Instructions: On a scale of 0 – 4, with '0' being "undesirable/poor," and '4' being "very desirable/good," please rate each of the following factors of this study by placing a check (√) in the respective box:

No.	Effectiveness/Suitability of:	Undesirable/ Very Poor 0	1	Average 2	3	Desirable/ Very Good 4
1	Time of the intervention sessions					
2	Duration of the intervention sessions					
3	Room used for intervention sessions					
4	Instructions provided in the intervention sessions					
5	Delivery of the intervention sessions					
6	Passages used for the intervention					
7	Practice opportunities (in-class)					
8	Cooperation of Group Members					
9	Incentive given for the pre-test and post-test					

State four (4) ***strengths*** of the Reciprocal Teaching intervention as they apply to you:

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

State four (4) ***weaknesses*** of the Reciprocal Teaching intervention as they apply to you:

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

Please rank each of the four (4) Reciprocal Teaching components (i.e. Clarifying, Predicting, Questioning, and Summarizing), as you perceive their effectiveness in improving reading-comprehension:

1. (Most Effective):_____

2._____

3._____

4. (Least Effective):_____

Please indicate which Reciprocal Teaching component has the most impact on your reading-comprehension skills (either Questioning **OR** Summarizing) by circling one:

Questioning Summarizing

When completed, please return this instrument to the Researcher.

Appendix D
Letters of Invitation to Participate in the Study

(Industrial Technology Students)

March 11, 2013.

Dear First-Year Industrial Technology Student.

Let me join in wishing you a very successful course of study as you embark on this phase of your professional and personal development. Indeed, exciting times are ahead for each of us!

I am a lecturer in the School of Technical and Vocational Education, currently completing doctoral studies in Curriculum and Instruction at Virginia Polytechnic Institute and State University (VPISU), Blacksburg, Virginia, USA. I am conducting an investigation into the application of a teaching method, and wish to study its impact among first-year students at UTech. This is an exciting, new project, never before attempted in our institution, and you are being invited to participate in this historic venture.

Part two of this study will be conducted over a period of approximately five weeks. Participants will be divided into two groups, and we will meet for two one-hour sessions per week, at a mutually convenient time. Unfortunately, only the randomly selected participants will be permitted to attend these sessions.

Should you volunteer to be a part of this educational study, you will be assigned a unique number, which will be used to identify you. You will be asked to complete a questionnaire and another Cloze test that should last for approximately 40 - 45 minutes duration. There is no need to study for this test, and I am sure you will enjoy the challenge of taking it.

I will have sole access to all the information collected, and wish to assure you of the highest level of confidentiality possible regarding your identity and responses. All data collected will be stored securely, and will be completely destroyed after the completion of the study. Upon completion of the study, I will provide all participants with a summary of the research findings if you so indicate by checking the box on the included consent form. You will also have access to a copy of the completed dissertation.

Please note that your participation in this study is completely voluntary, and will not impact in any way whatsoever your academic assessment at UTech. You have the right to discontinue your involvement in the study at any time without penalty, by informing me of your decision in writing.

On your part, both VPISU and UTech require that you read carefully, sign, date and return the enclosed consent form to me. By so doing, you will be indicating your willingness to voluntarily participate in this study.

I am truly excited to lead out in this study with you. I am also aware of the value of your time and effort, and wish to assure you that your involvement in this study will be both beneficial and

mutually rewarding. I believe that with your assistance, this research will result in an improved instructional delivery mode across the campus, and eagerly anticipate working with you.

Yours truly,

_____

Everton Lewis
Co-Investigator

Letter of Invitation to Participate in the Study
(Non-Industrial Technology Students)

March 11, 2013.

Dear First-Year Student.

Let me join in wishing you a very successful course of study as you embark on this phase of your professional and personal development. Indeed, exciting times are ahead for each of us!

I am a lecturer in the School of Technical and Vocational Education, currently completing doctoral studies in Curriculum and Instruction at Virginia Polytechnic Institute and State University (VPISU), Blacksburg, Virginia, USA. I am conducting an investigation into the application of a teaching method, and wish to study its impact among first-year students at UTech. This is an exciting, new project, never before attempted in our institution, and you are being invited to participate in this historic venture.

Should you volunteer to be a part of this educational study, you will be assigned a unique number, which will be used to identify you. You will be asked to complete a questionnaire and a cloze test. I will have sole access to this information, and wish to assure you of the highest level of confidentiality possible regarding your identity and responses. All data collected will be stored securely, and will be completely destroyed after the completion of the study.

The Cloze test should last for approximately 40 - 45 minutes duration. There is no need to study for this test, and I am sure you will enjoy the challenge of taking it. Upon completion of the study, I will provide all participants with a summary of the research findings if you so indicate by checking the box on the consent form. You will also have access to a copy of the completed dissertation.

Please note that your participation in this study is completely voluntary, and will not impact in any way whatsoever your academic assessment at UTech. You have the right to discontinue your involvement in the study at any time without penalty, by informing me of your decision in writing. On your part, both VPISU and UTech require that you read carefully, sign, date and return the enclosed consent form to me. By so doing, you will be indicating your willingness to voluntarily participate in this study.

I am truly excited to lead out in this study with you. I am also aware of the value of your time and effort, and wish to assure you that your involvement in this study will be both beneficial and mutually rewarding. I believe that with your assistance, this research will result in an improved instructional delivery mode across the campus, and eagerly anticipate working with you.

Yours truly,

_____

Everton Lewis
Co-Investigator

Appendix E
IRB, Assent and Informed Consent Forms

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Consent Form for Participants of Research Projects Involving Human Subjects
(Intervention and Post-Intervention Phases)

Title of Project: Reciprocal Teaching as a Reading-Comprehension Strategy among First-Year Industrial Technology Teacher-Education Majors at the University of Technology, Jamaica.

Investigator: Prof. Mark Sanders **Co-Investigator**: Everton Lewis

I. Purpose of the Study

The purpose of the intervention and post-intervention phases of the study will appraise the effectiveness of an instructional strategy at improving reading-comprehension scores among first-year Industrial Technology teacher-education majors at the University of Technology, Jamaica (UTech), with a view to make an evidence-based recommendation regarding the widespread implementation of this instructional strategy within the institution.

II. Procedure for Continuation of the study

The complete study incorporates the collection of pre-test data (Treatment, Control, and Comparison groups), an instructional strategy intervention with selected Industrial Technology students (i.e. Treatment group), and the collection of post-test data (Treatment and Control groups).

The instructional strategy intervention (Spring 2013 semester), will entail two groups of 20 (i.e. 40) Industrial Technology teacher-education majors (i.e. a Treatment and a Control group) taken from the initial 120 participants, matched on their pre-test cloze instrument test scores, being compared in a quasi-experimental research design. The post-test data collected will be analyzed quantitatively using SPSS software. An evaluation of the effectiveness of the instructional strategy will then be determined.

At this time the researcher will be conducting only the intervention and post-intervention phases of the study. A total of 40 primarily adult first-year male and female students enrolled at the Papine campus of the University of Technology, Jamaica for the 2012/13 Spring Semester will experience the intervention and provide intervention and post-intervention data, which consists of entry and exit questionnaires, intervention activities, and a cloze post-test. The intervention activities and cloze pre-test and post-test scores will be analyzed and subsequently compared using established rating standards to indicate the absence or existence of reading-comprehension problems, as well as the efficacy of the intervention strategy. There will also be a focus-group interview session as a terminal activity.

Should you choose to participate in this intervention/post-intervention phase of the study, you will be asked to attend approximately eight one-hour data collection sessions on campus at a

mutually convenient time, where you will be given exercises to complete, along with an untimed researcher-developed cloze-type post-test instrument. No special preparation is required in order to complete either of these instruments. The estimated duration of these data collection sessions is not expected to exceed 50 – 60 minutes each.

III. Involved Risks

There are no anticipated risks or known discomforts to you other than what you would experience in everyday academic activities.

IV. Benefits of this Project

No promise or guarantee of direct benefits has been made to encourage you to participate in the study. However, it is hoped that with your cooperation, the study will reveal useful information that will provide evidence on whether to implement the instructional strategy across the campus or not.

V. Extent of Anonymity and Confidentiality

Total anonymity and confidentiality cannot be guaranteed to the participants due to the interactive nature of the study. However, the highest degree of confidentiality feasible will be implemented. Any data collected will not be traceable to any participant, and no non-essential identifying information will be solicited. Throughout the duration of the study your child/ward will use a unique Student Code. Only the researcher will have access to this coded number. The researcher will make every effort to protect her/his identity, and her/his name will not be associated with the content of the survey. No person outside of the project will have access to any data collected for this study, which will be kept in a secured filing cabinet in a locked location.

At no time will the researcher release the results of the study to anyone other than the individuals working on the project without your written consent. The researcher will be willing to share summaries or drafts of all reports or papers with you before submitting them for publication. Publications about the findings from the study will **not** reveal the identity of your child/ward.

It is possible that the Virginia Tech. Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research.

VI. Compensation

Your participation in this study is voluntary and unpaid. However, a J$120 (≈US$1.40) telephone calling card will be given as an incentive for the completion of the post-test instruments. Participation or non-participation will NOT have any impact on your grades at UTech.

VII. Freedom to withdraw

You are free to withdraw from this study at any time and for any reason without penalty or adverse effect on your UTech academic grades. You can withdraw by contacting Everton Lewis (elewis@utech.edu.jm).

VIII. Approval of Research

This research has been approved, as required, by the Institutional Review Board for Studies involving Human Subjects at Virginia Polytechnic Institute and State University, and by the School of Graduate Studies, Research and Entrepreneurship at UTech.

10/22/2012 10/07/2013

_____ _____

IRB Approval Date **IRB Expiration Date**

IX. Participant's Responsibility

I voluntarily agree to participate in the intervention phase of this study as outlined. I will endeavor to attend both intervention data collection sessions at a mutually convenient time, and to complete the data collection instruments.

X. Participant's Permission

I have read the Consent Form and conditions of this project. I have had all my questions answered, and I understand that my participation in this study will have no impact on my grades while at UTech. By signing and dating this Consent Form I hereby acknowledge the above and give my voluntary consent to participate in the intervention phase of this study:

_____ _____

Name (please print) **Date**

_____

Participant's Signature

Contact Information:

I am aware that should I have any questions about this research or its conduct, I may contact:

Everton Lewis
Tel.: 927-1680-8 ext. 3580, or 789-5207
e-mail: elewis@utech.edu.jm

Prof. Mark Sanders (Chair, Advisory Committee)
Tel.: 1(540) 953-2967
e-mail: msanders@vt.edu

Dr. David Moore.
Chair,
Virginia Tech. Institutional Review Board for the Protection of Human Subjects
Office of Research Compliance
Tel.: 1(540) 231-4991
e-mail: moored@vt.edu

MINOR's ASSENT FORM
(Researcher's Copy)

This is to confirm that I have carefully read the **Parental Permission Form** which has been signed by my parent/guardian, and fully understand my rights as a minor to voluntarily participate in the study being undertaken by Mr. Everton Lewis. All my questions and concerns have been addressed to my satisfaction.
I understand my right to restricted confidentiality, and that I may withdraw from any further participation in this study by verbally informing my parent/guardian, or the researcher at any time, without penalty or prejudice. I also understand that, upon attaining age 18 years, I will have to submit a signed Consent Form if I intend to continue to participate in this study.
By affixing my signature and date to this form, I hereby assent to participate in this study, subject to the approval by my parent/guardian.

…… …….. ……
(Name) Signature Date

…… ……..
Group Student I.D. Number

MINOR's ASSENT FORM
(Student's Copy)

This is to confirm that I have carefully read the **Parental Permission Form** which has been signed by my parent/guardian, and fully understand my rights as a minor to voluntarily participate in the study being undertaken by Mr. Everton Lewis. All my questions and concerns have been addressed to my satisfaction.
I understand my right to restricted confidentiality, and that I may withdraw from any further participation in this study by verbally informing my parent/guardian, or the researcher at any time, without penalty or prejudice. I also understand that, upon attaining age 18 years, I will have to submit a signed Consent Form if I intend to continue to participate in this study.
By affixing my signature and date to this form, I hereby assent to participate in this study, subject to the approval by my parent/guardian.

……..…… …….. ……..
(Name) Signature Date

…… ……..
Group Student I.D. Number

Skype Recruitment Consent Form
(Student's Copy)

I have been informed that, by the use of the 'Skype' technology, my voice and any comments I make will be transmitted, along with partial images of me, in real-time, and that these audio and video data will NOT be recorded, stored, or be retrievable in any form in the future.

By placing my name, signature, and date to this Consent Form below, I hereby voluntarily agree to participate in the 'Skype Session' being conducted by the researcher. I have been informed of what is required of me, and understand that I may discontinue the Skype session at any time, without prejudice.

…….. …….. ……
Name Signature Date

Skype Recruitment Consent Form
(Researcher's Copy)

I have been informed that, by the use of the 'Skype' technology, my voice and any comments I make will be transmitted, along with partial images of me, in real-time, and that these audio and video data will NOT be recorded, stored, or be retrievable in any form in the future.

By placing my name, signature, and date to this Consent Form below, I hereby voluntarily agree to participate in the 'Skype Session' being conducted by the researcher. I have been informed of what is required of me, and understand that I may discontinue the Skype session at any time, without prejudice.

…….. …….. ……
Name Signature Date

Appendix F
Cloze Pre-test and Post-test Instruments, Answer Sheet, and Key.

Student Code #:_____ Group:_____

INSTRUCTIONS: Read the passage through carefully, and insert what you consider to be the best word for each blank in the corresponding numbered space on the answer sheet. Note that there is only **one** word missing from each blank. Words may be used more than once. This is **not** a timed exercise.

Psychoanalysis

Psychoanalysis is the school of psychology founded by a Viennese physician who fled to England in the 1930's to escape the Nazi tyranny--Sigmund Freud (1856-1939). Freud's theory, more than the others, has invaded the popular culture. You may already be familiar with _____(1). For example, an unstable _____(2) goes on a killing _____(3) on at least one _____(4) crime show each season. _____(5) the show's conclusion, a _____(6) typically explains that the _____(7) was "unconsciously" doing away _____(8) his own mother or _____(9). Or perhaps a friend _____(10) tried to "interpret" a ___ _____(11) of the tongue you _____(12) or has asked you _____(13) you thought might be _____(14) symbolic meaning of a _____(15).

The notions that people _____(16) driven by hidden impulses _____(17) that verbal slips and _____(18) represent unconscious wishes largely _____(19) the influence of Freud. _____(20) psychologists conducted their research _____(21) in the laboratory. Freud, _____(22), gained his understanding of _____(23) through clinical interviews. He _____(24) astounded at how little _____(25) people seemed to have _____(26) their motives. Some people _____(27), or rationalized, the most _____(28) behavior with absurd explanations. _____(29) seized the opportunity to _____(30) themselves for nearly every _____(31) that had befallen the _____(32) species.

Freud came to _____(33) that the unconscious processes, _____(34) primitive sexual and aggressive _____(35), were more influential than _____(36) thought in determining human _____(37). Freud thought that most _____(38) the mind was unconscious. _____(39) consisted of a seething _____(40) of conflicting impulses, urges, _____(41) wishes. People were motivated _____(42) gratify these impulses, ugly _____(43) some of them were. _____(44) at the same time, _____(45) were motivated to judge _____(46) as being decent. Thus, _____(47) would often delude themselves _____(48) their real motives. Because _____(49) the assumed motion of _____(50) forces in personality, Freud's theory is referred to as **psychodynamic.**

Please Turn Over

Research Methods

Independent and Dependent Variables

Consider an experiment to determine whether alcohol causes aggression. Experimental participants would be given alcohol, and its effects would be measured. In this case, alcohol is an _____(51) **variable**. The presence of _____(52) *independent variable* is manipulated _____(53) the experimenters so that _____(54) effects may be observed. _____(55) independent variable of _____(56) may be administered at _____(57) levels, or doses. It _____(58) range from none or _____(59) limited to enough to _____(60) intoxication or drunkenness.
The _____(61) results, or outcomes, in _____(62) experiment are called **dependent** _____(63). The presence of dependent _____(64) presumably depends on the _____(65) variables. In an experiment _____(66) determine whether alcohol influences _____(67), aggressive behavior would be _____(68) dependent variable. Other dependent _____(69) of interest in an _____(70) on the effects of _____(71) might include sexual arousal, _____(72) –motor coordination, and numerical _____(73).
In an experiment on _____(74) relationships between temperature and _____(75), temperature would be an _____(76) variable. Aggressive behavior would _____(77) a dependent variable. We _____(78) use temperature settings ranging _____(79) below freezing to blistering _____(80) and study the effects _____(81) each. We could also _____(82) a second independent variable _____(83) as social provocation as _____(84) affect aggression.
Experiments can _____(85) complex, with several independent _____(86) dependent variables. Psychologists often _____(87) complex experimental designs and _____(88) statistical techniques to determine _____(89) effects of each independent _____(90).

Experimental and Control Groups

Ideal experiments use experimental _____(91) control groups. Experimental participants _____(92) in the treatment. Members _____(93) control groups do not. _____(94) effort is made to _____(95) that all other conditions _____(96) held constant for both _____(97). This method enhances researcher's _____(98) that experimental outcomes are _____(99) by the treatments and _____(100) by chance factors or chance fluctuations in behavior.
Return to an experiment concerning the effects of alcohol on aggression. Members of the experimental group would ingest alcohol. Members of the control group would not. In a complex experiment, different experimental groups might ingest different doses of alcohol and be exposed to different types of social provocations.

Please Return This Instrument to the Lecturer.
Thank You for Your Cooperation.

N.B. This document was originally printed as one sheet (both sides) on legal-size (i.e. 8 ½" x 14") paper. It has been reduced to letter-size (i.e. 8 ½" x 11") for printing purposes.

CLOZE TEST ANSWER SHEET

Student Code #:_____ Group:_____

INSTRUCTIONS: Read the passage through carefully, and insert what you consider to be the best word for each numbered blank space in the corresponding space on this answer sheet. Note there is only one word missing from each blank, and that this is not a timed exercise. When you have finished completing the blanks, please answer the two questions at the end of the answer sheet.

1			26	
2			27	
3			28	
4			29	
5			30	
6			31	
7			32	
8			33	
9			34	
10			35	
11			36	
12			37	
13			38	
14			39	
15			40	
16			41	
17			42	
18			43	
19			44	
20			45	
21			46	
22			47	
23			48	
24			49	
25			50	

Please Turn Over

51		76	
52		77	
53		78	
54		79	
55		80	
56		81	
57		82	
58		83	
59		84	
60		85	
61		86	
62		87	
63		88	
64		89	
65		90	
66		91	
67		92	
68		93	
69		94	
70		95	
71		96	
72		97	
73		98	
74		99	
75		100	

Please answer these two questions by placing a check mark (✓) in the corresponding blank.

Q1: Do you own a personal copy of the textbook used for this course?

Yes ____ No ____

Q2: Have you read this passage before?

Yes ____ No ____

THANK YOU FOR YOUR COOPERATION!

Please return this instrument to the Researcher.

N.B. This document was originally printed as one sheet (both sides) on legal-size (i.e. 8 ½" x 14") paper. It has been reduced to letter-size (i.e. 8 ½" x 11") for printing purposes.

CLOZE TEST ANSWER KEY

1	it		26	into
2	person		27	justified
3	spree		28	abominable
4	T.V.		29	others
5	At		30	blame
6	psychiatrist		31	misfortune
7	killer		32	human
8	with		33	believe
9	father		34	especially
10	has		35	impulses
11	slip		36	conscious
12	made		37	behavior
13	what		38	of
14	the		39	It
15	dream		40	cauldron
16	are		41	and
17	and		42	to
18	dreams		43	as
19	reflect		44	But
20	Academic		45	people
21	mainly		46	themselves
22	however		47	they
23	People		48	about
24	was		49	of
25	insight		50	Underlying

51	independent		76	independent
52	an		77	be
53	by		78	could
54	its		79	from
55	The		80	hot
56	alcohol		81	of
57	different		82	use
58	may		83	such
59	very		84	they
60	cause		85	be
61	measured		86	and
62	an		87	use
63	variables		88	sophisticated
64	variables		89	the
65	independent		90	variable
66	to		91	and
67	Aggression		92	partake
68	a		93	of
69	variables		94	Every
70	experiment		95	ensure
71	alcohol		96	are
72	visual		97	groups
73	computations		98	confidence
74	the		99	caused
75	aggression		100	not

N.B. This document was originally printed as one sheet (both sides) on legal-size (i.e. 8 ½" x 14") paper. It has been reduced to letter-size (i.e. 8 ½" x 11") for printing purposes.

Appendix G
Complete Original Cloze Passages.

CLOZE TEST: PASSAGE 1

Psychoanalysis is the school of psychology founded by a Viennese physician who fled to England in the 1930's to escape the Nazi tyranny--Sigmund Freud (1956-1939). Freud's theory, more than the others, has invaded the popular culture. You may already be familiar with it. For example, an unstable person goes on a killing spree on at least one T.V. crime show each season. At the show's conclusion, a psychiatrist typically explains that the killer was "unconsciously" doing away with his own mother or father. Or perhaps a friend has tried to "interpret" a slip of the tongue you made, or has asked you what you thought might be the symbolic meaning of a dream.

The notions that people are driven by hidden impulses and that verbal slips and dreams represent unconscious wishes largely reflect the influence of Freud. Academic psychologists conducted their research mainly in the laboratory. Freud, however, gained his understanding of people through clinical interviews. He was astounded at how little insight people seemed to have into their motives. Some people justified, or rationalized, the most abominable behavior with absurd explanations. Others seized the opportunity to blame themselves for nearly every misfortune that had befallen the human species.

Freud came to believe that the unconscious processes, especially primitive sexual and aggressive impulses, were more influential than conscious thought in determining human behavior. Freud thought that most of the mind was unconscious. It consisted of a seething cauldron of conflicting impulses, urges, and wishes. People were motivated to gratify these impulses, ugly as some of them were. But at the same time, people were motivated to judge themselves as being decent. Thus, they would often delude themselves about their real motives. Because of the assumed motion of underlying forces in personality, Freud's theory is referred to as **psychodynamic.**

(298 words; 5% Passive Sentences; Flesch Reading Ease: 42.7; Flesch-Kincaid Grade Level: 11.1).

Source: Rathus, S. A., (2004). Psychology: Concepts and connections (Brief Version), (7^{th} ed.). pp. 12-13. Thomson-Wadsworth.

CLOZE TEST: PASSAGE 2

Research Methods
Independent and Dependent Variables

Consider an experiment to determine whether alcohol causes aggression. Experimental participants would be given alcohol, and its effects would be measured. In this case, alcohol is an **independent variable**. The presence of an *independent variable* is manipulated by the experimenters so that its effects may be observed. The independent variable of alcohol may be administered at different levels, or doses. It may range from none or very limited, to enough to cause intoxication or drunkenness.

The measured results, or outcomes, in an experiment are called **dependent variables**. The presence of dependent variables presumably depends on the independent variables. In an experiment to determine whether alcohol influences aggression, aggressive behavior would be a dependent variable. Other dependent variables of interest in an experiment on the effects of alcohol might include sexual arousal, visual–motor coordination, and numerical computations. In an experiment on the relationships between temperature and aggression, temperature would be an independent variable. Aggressive behavior would be a dependent variable. We could use temperature settings ranging from below freezing to blistering hot, and study the effects of each. We could also use a second independent variable such as social provocation as they affect aggression.

Experiments can be complex, with several independent and dependent variables. Psychologists often use complex experimental designs and sophisticated statistical techniques to determine the effects of each independent variable.

Experimental and Control Groups

Ideal experiments use experimental and control groups. Experimental participants partake in the treatment. Members of control groups do not. Every effort is made to ensure that all other conditions are held constant for both groups. This method enhances researcher's confidence that experimental outcomes are caused by the treatments and not by chance factors or chance fluctuations in behavior.

Return to an experiment concerning the effects of alcohol on aggression. Members of the experimental group would ingest alcohol. Members of the control group would not. In a complex experiment, different experimental groups might ingest different doses of alcohol and be exposed to different types of social provocations.

(332 words; 20% Passive Sentences; Flesch Reading Ease: 21.2; Flesch-Kincaid Grade Level: 13.5).

Source: Rathus, S. A., (2004). Psychology: Concepts and connection (Brief Version), (7th ed.). pp. 26-27. Thomson-Wadsworth.

Appendix H

Summary Evaluation Rubric

Instructions: Rate each category of the summary by placing a check (√) in the appropriate box, and indicate the weighting in the 'score' column. The 'total score' is the sum of the weighted scores.

Description	Excellent 4	Good 3	Below Average 2	Weak 1	Score
Topic Sentence	Starts with a clearly identifiable topic sentence	Has a topic statement in the first paragraph	Has a topic statement after the first paragraph	No topic statement identifiable	
Clarity of main Idea(s)	Has a clearly identifiable statement of all main idea(s)	Alludes to several of the main idea(s) of the passage	Has some central idea(s) that are not clearly identifiable	Does not identify the main idea(s) of the passage	
Critical content	All important critical content included	Has some critical content omitted	Some unnecessary content included	Too much unnecessary content included	
Supporting details	Includes only the most important supporting ideas	Includes a few unnecessary supporting ideas	Has too many unnecessary supporting details	Lacks important supporting details	
Organizational structure	Presented in same logical order as author	Only parts reflect the organizational order of author	Does not follow organizational structure of the author closely	No logical organizational structure	
Use of Language	Is appropriately paraphrased in own words	Significant portions are in own words	Only a small portion is paraphrased	Extensively uses authors words verbatim	
Grammatical Structure	Uses correct grammatical structure throughout	Is generally grammatically correct throughout	Has several grammatical errors throughout	Has many grammatical errors throughout	

Description	Excellent 4	Good 3	Below Average 2	Weak 1	Score
Comprehension of passage	Suggests a full comprehension of passage	Suggests a general comprehension of passage	Suggests a limited comprehension of passage	Does not suggest any comprehension of passage	
Personal interpretation of passage	Does not include any personal interpretation of content	Includes a limited personal interpretation of content	Includes a liberal personal interpretation of content	Includes extensive personal interpretation of content	
Extraneous content	Does not include any extraneous content	Has limited use of extraneous content	Has liberal use of extraneous content	Includes extensive use of extraneous content	
Length of Summary	10%-25% of specified wording	26%-44% of specified wording	45%-59% of specified wording	less than 10% or greater than 60% of specified wording	

Total Score =

Appendix I

Questioning Evaluation Rubric

(Cognitive Skills)

Instructions:
For each item generated, identify the 'type of question' and indicate the item in the 'number of items' box. To determine the 'score' per item-type, multiply the number of items by the respective 'item weight', and record the value in the 'score' column. The 'total score' is the sum of all of the item scores. Please record this value in the space provided.

Type of Question	Description	Item Weight[a]	Number of Items[b]	Score ($= a \times b$)
Remembering (Knowledge)	Recognizing, listing, describing, identifying, naming and recalling type items	1		
Understanding (Comprehension)	Interpreting, summarizing, classifying, comparing, and explaining type items	2		
Applying (Application)	Implementing, and using information types of items	3		
Analyzing (Analysis)	Comparing, organizing integrating and distinguishing type items	4		
Evaluating (Evaluation)	Checking, critiquing, judging, and justifying type items	5		
Creating (Synthesis)	designing, planning, producing, inventing and creating type items	6		

TOTAL SCORE =

Appendix J

Intervention Impact Self-Report Instrument (Treatment Group)

Dear First-Year Student.

Thank you for consenting to participate in this study. You are being asked to provide complete and accurate demographic data on this instrument. All information that is provided will be used only for the purpose of this educational research, and will be kept in strict confidence. No information will be released without your authorization.

Please note that your name will not be used throughout the duration of this study. The researcher will guide you through the creation of a unique student code number, which is to be used on ALL data collection instruments. Please memorize your STUDENT CODE NUMBER.

Demographic Data Sheet

INSTRUCTIONS: Please complete this instrument by checking (√) the appropriate box, or providing the requested information in the space provided.

1. Please state your Student CODE Number here: _____

2. What is your gender? (Please Check (√): Male ☐ Female ☐

3. What is your area of Specialization?
   - Construction Technology ☐
   - Electrical Technology ☐
   - Mechanical Technology ☐
   - I am a FELS student, but I am not an Industrial Technology student ☐
     - If so, Please state your Specialization:_____
   - I am not a FELS Student ☐
     - If so, Please state your Faculty:_____

4. Which type of Secondary School did you graduate from?
   - Technical High ☐
   - Traditional High ☐
   - Comprehensive High ☐
   - Other_____

5. What was your age-group on September 1, 2013?

   Under 18 Years Old _____; 18 – 22 Years Old _____; Over 22 Years Old _____;

6. Which Communication Course did you take in (2012) Semester 1?

   Fundamentals of Communication ☐ Academic Writing 1 ☐
   Academic Writing 2 ☐ None ☐

7. Have you ever participated in a Reading-Comprehension Assessment? ☐YES ☐NO

   If so, Please state where and when:_____

8. i. How many **books** have you read for pleasure in the past six months? _____

   ii. How many book **chapters** have you read for pleasure in the past six months? _____

9. i. How many complete school-related **textbooks** have you read in the past six months? ____

   ii. How many school-related **textbook chapters** have you read in the past six months? ___

10. Which **<u>one</u>** of the following learning strategies do you learn **<u>best</u>** by?

    Hearing (i.e. lectures, audio materials) ☐
    Viewing (i.e. video materials, demonstrations etc.) ☐
    Reading (i.e. text-based materials) ☐

11. On a scale of 1 through 10, with 1 being 'very weak' and 10 being 'very strong', how do you rate your current reading-comprehension skills (please circle one number).

Very Weak									Very Strong
1	2	3	4	5	6	7	8	9	10

12. Do you believe that you can improve your current reading-comprehension skill level?
    YES ☐ NO ☐

Thank you for your participation. Once you have completed answering all the questions, please return this instrument to the researcher.

Appendix K
Entry Questionnaire

ENTRY SURVEY INSTRUMENT

The following demographic information is needed to assist in the interpretation of the data that will be collected during the next few weeks. Please answer the questions as honestly and as completely as you can. If there are any questions or concerns, please consult with the researcher. Thank you for your cooperation.

---

1. Please provide your Research Code Number here: _____
2. What is your Gender? (Please circle): Female Male
3. Which Age Group are you in? Under 18 years 18 – 22years Over 22 years (Please circle)
4. Which Group are you enrolled in? Construction Electrical Mechanical (Please circle)
5. Which High School did you graduate from? _____
6. When applying to UTech, what was your faculty of first-choice?

   _____
7. When applying to UTech, what was your faculty of second-choice?

   _____

INSTRUCTION:

Please answer the following items by placing a check (√) in the column that represents your response.

	Always	**Sometimes**	**Hardly**	**Never**
Before you begin reading, do you ask yourself:				
What do I think this passage might be about?				
Why do I think so?				
How important is this information for me to know?				
Do I already understand this information?				
During the reading of a passage, do you ask yourself the following questions:	**Always**	**Sometimes**	**Hardly**	**Never**
What is going on in my mind right now?"				
What am I thinking about?				
Do I need to concentrate on this passage?				

	Always	Sometimes	Hardly	Never
Are there any sections of this passage that are too hard to understand?				
What can I do when I come to sections that are hard to understand?				
Are there any hard words that I do not understand?				
What can I do when I come across hard words?				
What do I predict will happen next in the passage?				
Should I revise my prediction(s), based on new information?				
	Always	**Sometimes**	**Hardly**	**Never**
Do you consider (i.e. think about) information you have read previously?				
Can I make an inference about what I am reading?				
Is this information consistent with my prior knowledge?				

After reading a passage, do you:	**Always**	**Sometimes**	**Hardly**	**Never**
Draw conclusions about what you have read?				
Make any judgment(s) about what you have read?				
Visualize or create mental images about what you have read?				
Paraphrase what you have read?				
Summerize what you have read?				
Construct questions about what you have read?				
Reason about what you read?				
Monitor your understanding of what you are reading?				
Use context to figure out difficult words?				
Reread difficult sections?				
Use illustrations to help you with comprehending the passage?				

Thank you very much for your cooperation.

Please return this instrument to the researcher.

Appendix L
Exit Questionnaire Instrument

EXIT SURVEY INSTRUMENT

The following demographic information is needed to assist in the interpretation of the data that will be collected during the next few weeks. Please answer the questions as honestly and as completely as you can. If there are any questions or concerns, please consult with the researcher. Thank you for your cooperation.

---

1. Please provide your Research Code Number here: _____

2. Do you think that you have learned anything during this study?
   (Please write in the space provided)

   _____

   _____

   _____

   _____

3. What did you like the most about this study?

   _____

   _____

   _____

   _____

4. What did you like the least about this study?

   _____

   _____

   _____

   _____

5. Is there anything about this study that you would like to be changed?

   _____

   _____

   _____

   _____

6. How, in your opinion, can this study be improved for future replication?

_____

_____

_____

_____

INSTRUCTION:

Please answer the following items by placing a check (√) in the column that represents your response.

Before you begin reading, do you ask yourself:	**Always**	**Sometimes**	**Hardly**	**Never**
What do I think this passage might be about?				
Why do I think so?				
How important is this information for me to know?				
Do I already understand this information?				
During the reading of a passage, do you ask yourself the following questions:	**Always**	**Sometimes**	**Hardly**	**Never**
What is going on in my mind right now?"				
What am I thinking about?				
Do I need to concentrate on this passage?				
Are there any sections of this passage that are too hard to understand?				
	Always	**Sometimes**	**Hardly**	**Never**
What can I do when I come to sections that are hard to understand?				
Are there any hard words that I do not understand?				
What can I do when I come across hard words?				
What do I predict will happen next in the passage?				
Should I revise my prediction(s), based on new information?				
Is this information consistent with what I predict it to be?				
Can I make any inference(s) about what I am reading?				
Is this information consistent with my prior knowledge?				

After reading a passage, do you:	Always	Sometimes	Hardly	Never
Draw conclusions about what you have read?				
Make any judgment(s) about what you have read?				
Visualize or create mental images about what you have read?				
Paraphrase what you have read?				
Summerize what you have read?				
Construct questions about what you have read?				
Reason about what you read?				
Monitor your understanding of what you are reading?				
Use context to figure out difficult words?				
Reread difficult sections?				
Use illustrations to help you with comprehending the passage?				

Adapted from Gunning (2002).

Thank you very much for your considered opinions.

Please return this instrument to the researcher.

Appendix M
Team-building and Group-Dynamics Activities

Activity 1:

C4N U R34D 7H15?

7H15 M3554G3 53RV35 70 PR0V3 H0W 0UR
M1ND5 C4N D0 4M4Z1NG 7H1NG5!
1MPR3551V3 7H1NG5! 1N 7H3 B3G1NN1NG
17 WA5 H4RD BU7 N0W, 0N 7H15 LIN3 Y0UR
M1ND 1S R34D1NG 17 4U70M471C4LLY
W17H 0U7 3V3N 7H1NK1NG 4B0U7 17.

B3 PR0UD! 0NLY C3R741N P30PL3 C4N R3AD 7H15.

Source Unknown

Adapted from *Bloom's Digital Taxonomy* (n.d.). Retrieved on December **12, 2012, from** http://edorigami.wikispaces.com/Bloom%27s+Digital+Taxonomy

CAN YOU READ THIS!

If you can read this message with ease you are twisted!
You also have an awesome talent!
This passage is both backwards and upside down!
You probably will make a good teacher!

Source Unknown

Activity 2: Visual Cognition Videos.
Simons, D. (n.d.). Visual Cognition Videos. Retrieved on April 17, 2006 from http://www.youtube.com/watch?v=IGQmdoK_ZfY&playnext=1&list=PLB228A1652CD49370&feature=results_video

Activity 3:
A man is the owner of a winery who recently passed away. In his will, he left 21 barrels (seven of which are filled with wine, seven of which are half full, and seven of which are empty) to his three sons. However, the wine and barrels must be split so that each son has the same number of full barrels, the same number of half-full barrels, and the same number of empty barrels. Note that there are no measuring devices handy. How can the barrels and wine be evenly divided?

Answer: Two half-full barrels are dumped into one of the empty barrels. Two more half-full barrels are dumped into another one of the empty barrels. This results in nine full barrels, three half-full barrels, and nine empty barrels. Each son gets three full barrels, one half-full barrel, and three empty barrels.

Activity 4:
Three men are captured by cannibals in the jungle. The men are given one chance to escape with their lives. The men are lined up and bound to stakes such that one man can see the backs of the other two, the middle man can see the back of the front man, and the front man can't see anybody. The men are shown five hats, three of which are black and two of which are white. Then the men are blindfolded, and one of the five hats is placed on each man's head. The remaining two hats are hidden away. The blindfolds are removed. The men are told that if just one of the men can guess what hat he's wearing, they may all go free. Time passes. Finally, the front man, who can't see anyone, correctly guesses the color of his hat. What color was it, and how did he guess correctly?

Answer: The back man can see the hats worn by the two men in front of him. So, if both of those hats were white, he would know that the hat he wore was black. But, since he doesn't answer, he must see at least one black hat ahead of him. After it becomes apparent to the middle man that the back man can't figure out what he's wearing, he knows that there is at least one black hat worn by himself and the front man. Knowing this, if the middle man saw a white hat in front of him, he'd know that his own hat was black, and could answer the question correctly. But, since he doesn't answer, he must see a black hat on the front man. After it becomes apparent to the front man that neither of the men behind him can answer the question, he realizes the middle man saw a black hat in front of him. So he says, correctly, "My hat is black."

Activity 5:
Given that in a certain country the following equations are true:
9 + 2 = 711
8 + 5 = 313
5 + 2 = 37
7 + 6 = 113

Solve the following equations:
9 + 8 = **(117)**
10 + 6 = **(416)**
15 + 3 = **(1218)**

Activity 6:
A man is on a game show. He is presented with two doors, one on the left, and one on the right. Behind one is 2 million dollars, and behind the other is a donkey. Choose the correct door to win the prize. There are also two men in front of the doors, and they know which door leads to the millions. One wears a black hat, the other wears a white hat. The host explains that one of the men is a liar, and will always lie, and the other man will always tell the truth - but you don't know which is which. You can ask only one of the men only one question. What is the question, and which man do you ask to ensure you win the money?

Answer: You ask either man the following question: "If I asked the other guy which door has the money, what would he say?", then choose the opposite door. Work it out: If you ask the question to the liar, he will lie about the 'correct' answer, so you must choose the opposite door. If you ask the truth teller, he will tell the truth about the lie, so you can choose the opposite door as well.

Activity 7:
You are in a room that has 3 switches and a closed door. The switches control 3 light bulbs on the other side of the door. Once you open the door, you may never touch the switches again.

How can you definitively tell which switch is connected to each of the light bulbs?

Answer: Turn on the first 2 switches. Leave them on for 5 minutes. Once 5 minutes has passed, turn off the second switch, leaving one switch on. Now go through the door. The light that is still on is connected to the first switch, whichever of the other two is warm to the touch is connected to the second switch. The bulb that is cold is connected to the switch that was never turned on!!

Activity 8:
You are on the bank of a river. You have to get a fox, a hen, and corn to the other site of the river. If left alone, the fox will eat the hen, the hen will also eat the corn if left alone. The boat is only big enough to take you and one other three to the other side. How do you get all 3 across intact?

Answer: First take the hen across. Leave the hen. Go back and get the fox. Take the fox to the other side. Leave the fox there, but take the hen with you back to get the corn. Leave the hen and take the corn to the other side. Drop the corn off with the fox, then go back to get the hen. Bring the hen to the other side. All 3 make it fully intact!

Activity 9:
You are driving a bus. At the first stop, 2 women get on. The second stop, 3 men get on and 1 woman gets off. Third stop, 3 kids and their mom get on, and a man gets off. The bus is grey, and it is raining outside. What color is the bus drivers hair?

Answer: Whatever color your hair is! Remember, you are the bus driver!

Source: TheTeachersCorner.net (n.d.). Retrieved on September 22, 2011 from http://worksheets.theteacherscorner.net/make-your-own/brain-teasers/

Appendix N
Summary and Questioning Assessment Passages

SPANGLISH SPOKEN HERE

In Manhattan a first-grader greets her visiting grandparents, happily exclaiming, "Come here, sientate!" Her bemused grandfather, who does not speak Spanish, nevertheless knows she is asking him to sit down. A Miami personnel officer understands what a job applicant means when he says, "Quiero un part time." Nor do drivers miss a beat reading a billboard alongside a Los Angeles street advertising CERVEZA-SIX-PACK!

This free-form blend of Spanish and English, known as Spanglish, is common linguistic currency wherever concentrations of Hispanic Americans are found in the U.S. In Los Angeles, where 55 percent of the city's three million inhabitants speak Spanish, Spanglish is as much a part of daily life as sunglasses. Unlike the broken-English efforts of earlier immigrants from Europe, Asia, and other regions, Spanglish has become a widely accepted conversational mode used casually-even playfully-by Spanish-speaking immigrants and native-born Americans alike.

Consisting of one part Hispanicized English, one part Americanized Spanish, and more than a little fractured syntax, Spanglish is a bit like a Robin Williams comedy routine, a crackling line of cross-cultural patter straight from the melting pot. Often it enters Anglo homes and families through the children, who pick it up at school or at play with their young Hispanic contemporaries. In other cases, it comes from watching TV; many an Anglo child watching Sesame Street has learned "uno, dos, tres" almost as quickly as "one, two, three."

Spanglish takes a variety of forms, from the Southern California Anglos who bid farewell with the utterly silly "hasta la bye-bye" to the Cuban American drivers in Miami who "parquean their carros." Some Spanglish sentences are mostly Spanish, with a quick detour for an English word or two. A Latino friend may cut short a conversation by glancing at his watch and excusing himself with the explanation that he must "ir al supermarket."

Many of the English words transplanted in this way are simply handier than their Spanish counterparts. No matter how distasteful the subject, for example, it is still easier to say "income tax" than "impasto sobre la renta." At the same time, many Spanish-speaking immigrants have adopted such terms as VCR, microwave, and dishwasher for what they view as largely American phenomena. Still other English words convey a cultural context that is not implicit in the Spanish. A friend who invites you to "lonche" most likely has in mind the brisk American custom of "doing lunch" rather than the languorous afternoon break traditionally implied by "almuerzo."

Mainstream Americans exposed to similar hybrids of German, Chinese, or Hindi might be mystified. But even Anglos who speak little or no Spanish are somewhat familiar with Spanglish. Living among them, for one thing, are 19 million Hispanics. In addition, more American high school and university students sign up for Spanish than for any other foreign language.

Only in the past ten years, though, has Spanglish begun to turn into a national slang. Its popularity has grown with the explosive increases in U.S. immigration from Latin American

countries. English has increasingly collided with Spanish in retail stores, offices and classrooms, in pop music and on street corners. Anglos whose ancestors picked up such Spanish words as rancho, bronco, tornado, and incommunicado, for instance, now freely use such Spanish words as gracias, Bueno, amigo, and por favor.

Among Latinos, Spanglish conversations often flow easily from Spanish into several sentences of English and back.

Spanglish is a sort of code for Latinos: the speaker knows Spanish, but their hybrid language reflects the American culture in which they live. Many lean to shorter, clipped phrases in place of the longer, more graceful expressions their parents used. Says Leonel de la Cuesta, an assistant professor of modern languages at Florida International University in Miami:" In the U.S., time is money, and that is showing up in Spanglish as an economy of language." Conversational examples: taipier (type) and winshi-wiper (windshield wiper) replace escribir a maquina and Iimpia para brisas.

Major Advertisers, eager to tap the estimated $134 billion in spending power wielded by Spanish-speaking Americans, have ventured into Spanglish to promote their products. In some cases, attempts to sprinkle Spanish through commercials have produced embarrassing gaffes. A Braniff airlines ad that sought to tell Spanish-speaking audiences they could settle back en (in) luxuriant Cuero (leather) seats, for example, inadvertently said they could fly without clothes (encuero). A fractured translation of the Miller Lite slogan told readers the beer was "Filling, and less delicious." Similar blunders are often made by Anglos trying to impress Spanish-speaking pals. But if Latinos are amused by mangled Spanglish, they also recognize these goofs as a sort of friendly acceptance. As they might put it, "No problema."

Castro, Janice. (2011). Spanglish Spoken Here. Mosaics: Reading and writing essays. (5th Ed.). Kim Flachmann. Boston: Prentice Hall. Pp. 353-6.

The Resources and Methods of Technology

If a time machine could take you back to prehistoric times, would you be smarter, stronger, or faster than the people of that time period? Before you answer, you should know that there is a limitation to this fictional time machine. It requires you to go back through time just like Arnold Schwarzenegger in the movie *The Terminator*, without any of the things that have been created by technology.

Would you know how to survive in the wilderness? You would have to do a lot of improvising and use your knowledge to survive in this ancient environment. To survive against the meat-eating animals, you would need to do a lot of inventing or hiding. You wouldn't be able to run as fast, see as far, or hear as small a sound as the predators that would view you as a possible dinner.

What resources and methods did our earliest ancestors use to create the tools and weapons they needed to protect themselves and keep themselves alive? What resources and methods do we use today to create communication-age tools and devices to make our lives easier and more enjoyable? In this chapter you will learn the answers to these questions.

The Technology Recipe

What ingredients do you need to create technology?

Technology comes from the knowledge and skill that is needed to use raw materials, tools, and energy to create the products and services that we want. The same resources used in ancient days are still being used today to develop new technology.

Our early ancestors knew very little compared to what people know today. But our ancestors were still able to use their limited knowledge to create Stone Age tools. They used their hands to grasp, shape and form natural materials into useful tools. Their tools were simple and crude by our standards. Our tools will seem simple and crude to people in the twenty-second century.

To create new technology today, people use the same ingredients that were used by our earliest ancestors. These ingredients are called **resources** and they include all of the following:

*People	*Capital	*Knowledge
*Time	*Creativity	*Materials
*Skill	*Energy	*Tools and machines

People

Why can't we create technology without people?

Any list of ingredients needed to create technology must start with people. People are the creators of technology.

If we subtract the human element from our list of resources, what do we have left? The resources time, energy, and materials existed for millions of years before people. But technology didn't advance at all during these millions of years. It wasn't until people came along that technology began to advance.

Many animals use sticks and stones to get food, but most have never learned to improve these tools that came from their natural surroundings. People, on the other hand, not only learned to

create new tools, but also passed their inventions on to future generations. Each generation has the opportunity to benefit from the accomplishments of the past.

Besides being the creators of technology, people are also the end users of the products that their technology has built. Between the designer and the end user are many jobs that must be done by people. People build the tools and machines, set up the factories, run the machines, and finally package and ship the end products.

Other people are in the service area of our technology. They sell, install, and repair these products. People use technology in health care facilities, on farms, in businesses, and in schools.

Remember, it is our capacity to create technology that led to our powerful position on our planet. Our early weapons turned us into hunters rather than the hunted. Our telescopes and microscopes gave us the eyes to see the invisible. Our telephones and satellites gave us the ability to hear whispers over fantastic distances. The computer gave us the ability to recall the smallest of details and solve problems in seconds that people wondered about for centuries.

Knowledge

Why do we need knowledge to create new technology?

Knowledge is wisdom, information, learning, scholarship, and understanding. If an animal uses a stick to push food into its reach, is knowledge or technology being used?

Our definition of technology calls for the use of knowledge, skill and natural resources to meet our needs and wants. If a chimp takes a branch (natural resource) and moves an object into its reach (skill), it is using technology to get food (needs). A bird's nest is a complex construction project that uses bird technology.

The big difference between humans and other species is that we learn from our past experiences. When our early ancestors used sticks to gather food, they used elementary technology similar to that used by a chimp. This basic tool was refined by each generation and passed down to us. People learned (gained knowledge) that a stone attached to the stick improved its performance. Others learned that the reaching stick could be thrown.

(Pierce, A., and Karwatka, D. (1999). Introduction To Technology. Glencoe/McGraw-Hill, Il., p. 33-35. Figures have been omitted from this version of the article).

Appendix O
Questioning Practice Passages

Garlic cure supported

West German researchers have a Solution to cholesterol clogged blood vessels. It is garlic. Old wives have for centuries claimed that garlic cures many ills from snake bites to toothache. Now, according to Professor Hans Reuter, of Cologne, there is proof that garlic helps to clear the fat accumulating in the blood vessels of those who eat rich food, so reducing the danger of heart attacks. Tests showed that volunteers fed on butter containing 50 grams of garlic oil had a cholesterol level considerably lower than that of a control group fed on butter without garlic. In another experiment, patients ate three grams of raw garlic a day. After four weeks their cholesterol level fell markedly. According to Professor Renter, garlic not only drives out unwanted fats in blood. Tests indicated that the herb also kills other bacteria, among them those causing diphtheria and tuberculosis. Professor Reuter said garlic was in some cases more effective than penicillin. To get the full benefit. you must use fresh garlic. Garlic powder won't work any medicinal miracles, since the plant loses its healing properties when processed.

Passage and exercise retrieved from http://www.uefap.com/writing/exercise/report/garlfram.htm on May 22, 2012.

Democratic Socialism by Michael Foot

The best example that I've seen of Democratic Socialism operating in this country was during the Second World War. Then we ran Britain highly efficiently, got every-body into a job. It wasn't so difficult then to employ people who were disabled and in difficulties and all the rest of it. We wanted to use all their efforts, and we found the money to do it. We also produced, I would have thought, probably more than any other country including Germany. We mobilised better. The conscription of labour was only a very small element of it. We also did what I think we ought to do on a far greater scale now, looking after the people who are worst hit. In the war, instead of saying because (the country) is in extreme circumstances you've got to cut the pay of the people who are worst off, they did the opposite. They increased the pensions, the social security. It was a democratic society with a common aim in which many of the class barriers were being broken down. Many of us thought we would never return to a society in which class barriers were rebuilt. Many of them have been. And many of those class barriers are the very things which have injured the community since.

Passage and exercise retrieved on May 22, 2012 from
http://www.uefap.com/writing/exercise/report/footfram.htm

Acquiring new knowledge.

In all learning, advances tend to come irregularly and in bursts, as you gain fresh insights into the subject. In order to obtain these insights you must thoroughly understand what you are studying. If you really understand a subject not only do you remember it easily, but you can apply your know ledge in new situations. The important thing is not what you know, but what you can do with what you know. The extra effort involved in getting a firm grounding in the essentials of a

subject is repaid many times in later study. How are you to achieve understanding? Understanding involves (1) linking new knowledge to the old and (2) organizing it and remembering it in a systematic fashion. To retain and make sense of any new concept or fact it must be linked in as many ways as possible to your existing body of knowledge. All good introductory textbooks are constantly giving familiar examples, or using analogies, or appealing to common experience. In setting out the differences between daylight vision and twilight vision, for example, most writers point out that as twilight falls in the garden, blue flowers remain blue for some time after red blossoms appear black, illustrating, by appeal to common experience, that under dim illumination the colours of the blue end of the spectrum become relatively brighter than those of the red end. Or again, to illustrate that the movement of any particular electron during the passage of an electric current is only a few centimetres a second, although the velocity of the current is extremely great, the analogy is often used of a truck run into the end of a long line of trucks in a shunting yard, a corresponding truck being rapidly ejected from the far end. Linking new information to familiar experience in this fashion always helps understanding. In order to tie the new information to your stock of knowledge with as many links as possible, you must reflect on it, and try and relate it to what you already know. Thinking the matter over by yourself, writing out summaries of the main points, and talking to other students about it, are all valuable for fixing it more clearly in your mind.'
How to Study, Maddox (Pan)

Passage and exercise retrieved on May 22, 2012 from
http://www.uefap.com/writing/exercise/report/acqfram.htm

Appendix P
Preliminary Statistical Tests to Justify Use of Parametric Analyses

Assumptions Tested

The data collected are normally distributed.

1. Treatment Group Pre-Test Scores vs. Control Group Pre-Test Scores

Normal Quantile Plot: Checks for normality of data. The data is assumed normal if the points fall close to the 45 degree line.

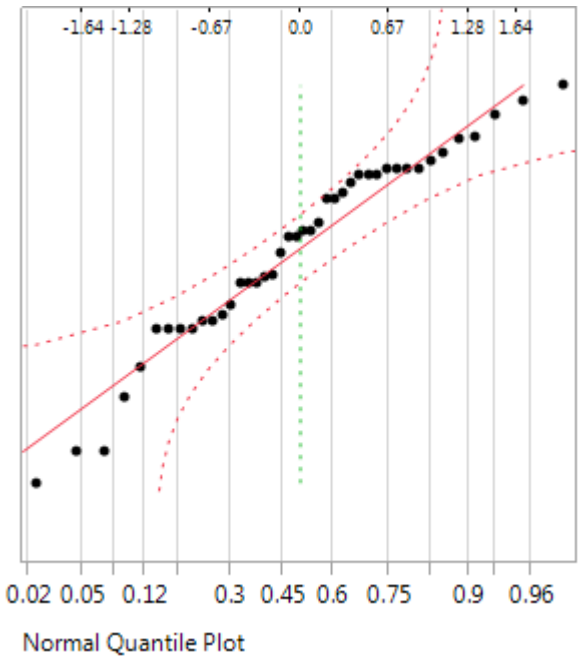

Figure A-P1. Normal Quantile Plot of Treatment and Control Groups Cloze Pre-test Scores

The formal test for normality of data using the Shapiro-Wilk Test.

Shapiro-Wilk (*W*) Test

W	**Prob < *W***
.955342	0.1005

Note: H_o = The data is from the Normal distribution. Small *p*-values reject H_o.

The *p*-value of 0.1005 is insignificant, meaning there is no reason to believe the data is not normal.
The assumption of Constant Variance of the data can be checked using the Levene's test.
H_0: the variances are the same vs. H_A: the variances are not the same

Test	F	*p*-value
Levene	1.6112	0.2117

The *p*-value of 0.2117 is insignificant meaning there is no reason to believe the variances are unequal for the two groups.

---

2. Pre-Test vs. Post-Test for Treatment Group

Normal Quantile Plot: Checks for normality of data. The data is assumed normal if the points fall close to the 45 degree line.

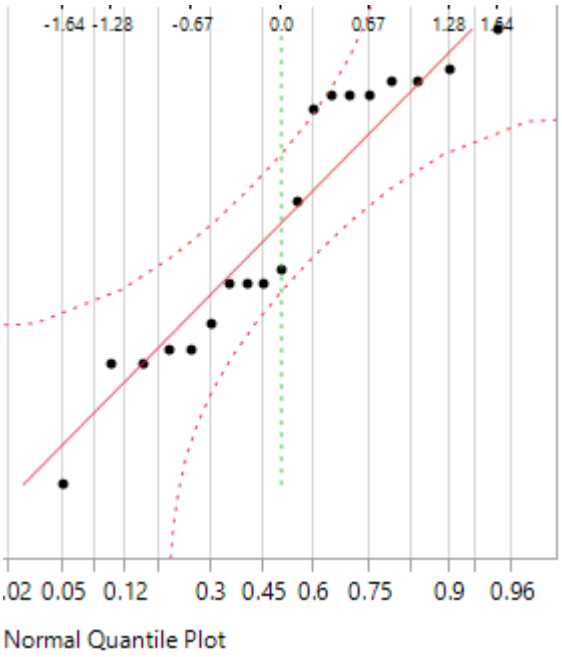

Figure A-P2. **Normal Quantile Plot of Treatment Group's Cloze Pre-test vs Post-test Scores**

The formal test for normality of the data by means of the **Shapiro-Wilk Test**.

W	**Prob < *W***
0.902514	**0.0540**

Note: H_o = The data is from the Normal distribution. Small *p*-values reject H_o.
The *p*-value of 0.0540 is insignificant, meaning there is no reason to believe the data is not normal.

The assumption of Constant Variance of the data can be checked using Levene's test.
H_0: the variances are the same vs. H_A: the variances are not the same

Test	F Ratio	*p*-Value
Levene	2.5984	0.1157

The *p*-value of 0.1157 is insignificant meaning there is no reason to believe the variances are unequal for the two groups.

---

3. Pre-Test Scores vs. Post-Test Scores for the Control Group

Normal Quantile Plot: Checks for normality of the data. The data is assumed normal if the points fall close to the 45 degree line.

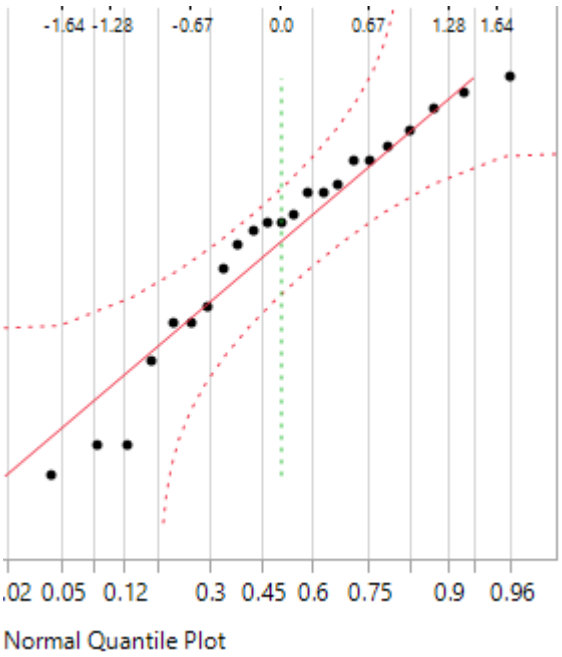

Figure A-P3. **Normal Quantile Plot of Control Group's Cloze Pre-test vs. Post-test Scores**

The formal test for normality of the data is by means of the Shapiro-Wilk Test.

W	Prob < *W*
0.937741	0.1607

Note: H_o = The data is from the Normal distribution. Small *p*-values reject H_o.

The *p*-value of 0.1607 is insignificant meaning there is no reason to believe the data is not normal.

The assumption of Constant Variance of the data can be checked using Levene's test.
H_0: the variances are the same vs H_A: the variances are not the same

Test	F Ratio	*p*-Value
Levene	2.8892	0.0964

The *p*-value of 0.0964 is insignificant meaning there is no reason to believe the variances are unequal for the two groups.

---

4. Pre-Tests Scores for FELS-IT vs. FELS-non IT vs. Non-FELS Groups·

Normal Quantile Plot: Checks for normality of the data. The data is assumed normal if the points fall close to the 45 degree line.

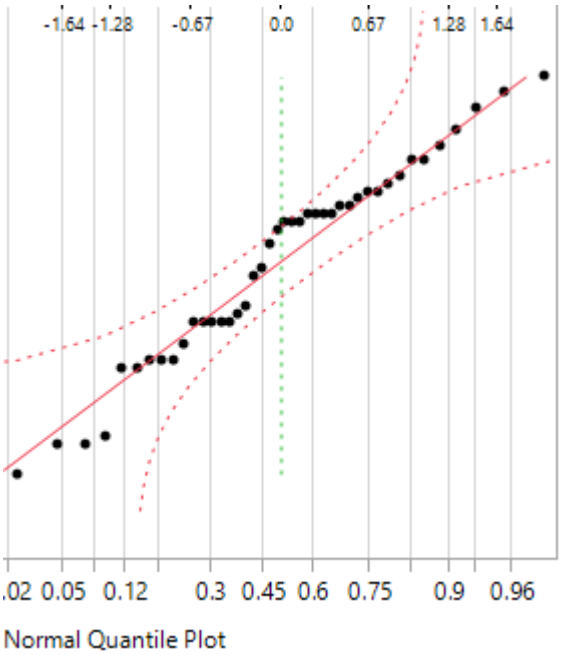

Figure A-P4. **Normal Quantile Plot of FELS-IT vs. FELS-non-IT vs. non-FELS Cloze Pre-test Scores**

The formal test for Normality of data is the Shapiro-Wilk Goodness of Fit Test.

Goodness-of-Fit Test

W	Prob < *W*
0.964616	0.2155

Note: H_o = The data is from the Normal distribution. Small *p*-values reject H_o.

The *p*-value of 0.2155 is insignificant meaning there is no reason to believe the data is not normally distributed.

The assumption of Constant Variance can be checked using Levene's test.

H_0: variances are the same vs. H_A: the variances are not the same

Test	**F Ratio**	***p*-Value**
Levene	2.0943	0.1273

The *p*-value of 0.1273 is insignificant, meaning there is no reason to believe the variances are unequal for the two groups.

A two-sample t-test analysis was completed to initially determine if there was a significant difference in pre-test scores for the treatment and control groups. It was necessary to identify this difference in order to determine if the two groups were homogenous before the treatment was applied. The hypotheses of interest are:

H_0	$\mu_{control} = \mu_{treatment}$	Pre-Test Group
H_1	$\mu_{control} \neq \mu_{treatement}$	Pre-Test Group

The average pre-test score for the control group was 30.70% and the for the treatment group 24.58%. This resulted in an estimated difference for the treatment group's pre-test score minus the control group's score of -6.12%. The test statistic for the two-sample t-test analysis was -1.54 with a p-value of 0.1325. Thus, there is not enough statistical evidence to suggest a significant difference in pre-test scores for the treatment and control groups. Figure A-1 illustrates the comparison of the pre-test scores for the control and treatment groups. Each error bar on the bar chart is constructed using one standard deviation from the mean. Even though the mean score for each group differs when taking the variability into account this difference is not significant.

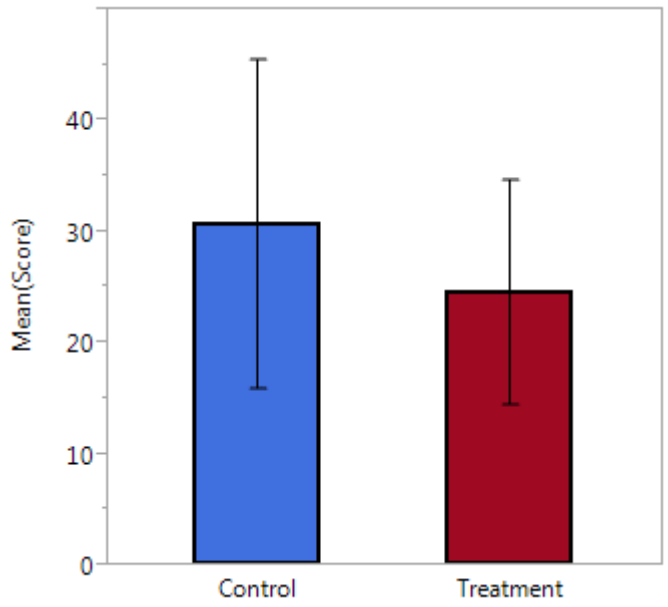

***Figure A*-P5. Bar chart comparison of the Treatment and Control Groups mean pre-test scores.**

Each error bar is constructed using 1 standard deviation from the mean.

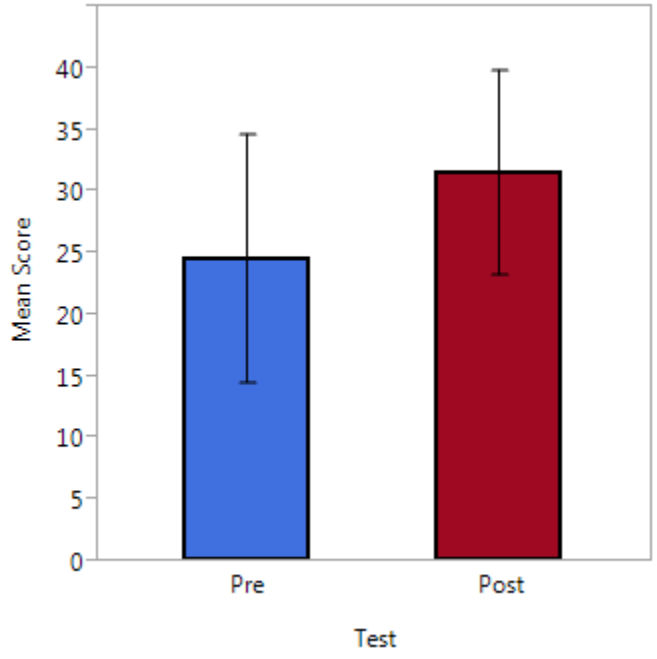

***Figure A*-P6. Bar chart comparison for the Treatment Group's mean pre- and post-test scores.**

Each error bar is constructed using 1 standard deviation from the mean.

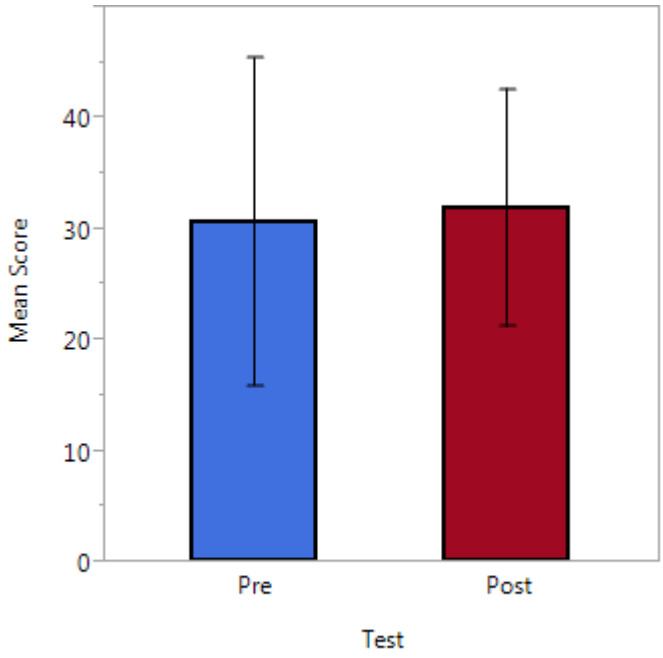

***Figure A-P7*. Bar chart comparison for the Control Group's mean Pre- and Post-test scores.**

Each error bar is constructed using 1 standard deviation from the mean.

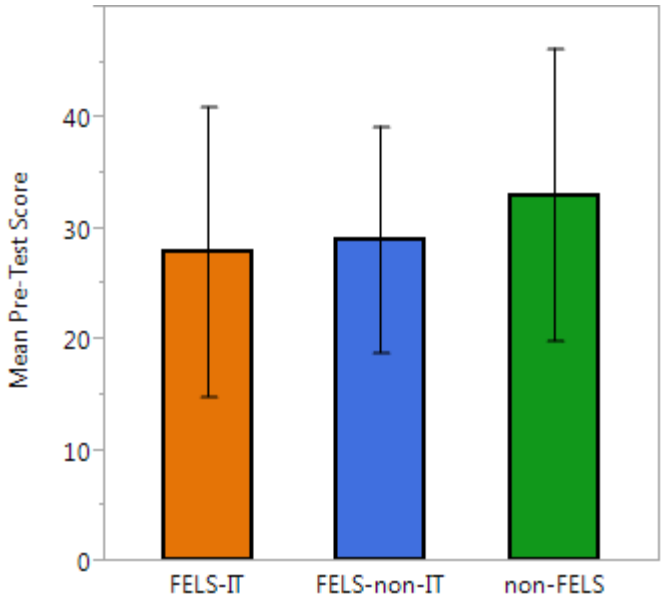

***Figure A*-P8. Bar chart comparison of the mean Pre-test scores for the FELS-IT, FELS-non-IT, and non-FELS Groups.**

Each error bar is constructed using 1 standard deviation from the mean.

Appendix Q
Supplementary Summary and Questioning Practice Articles

How Lie Detectors Work

For more than 15 years, Robert Hanssen led a double life. In one life he was a 25-year veteran with the Federal Bureau of Investigation (FBI) who had access to some of the nation's most-classified information. In his other life, he allegedly was spying for the Russian government. Hanssen's deception was finally discovered, and in February 2001 he was arrested and later pled guilty to 15 espionage-related charges. Spies are probably the world's best liars, because they have to be, but most of us practice deception on some level in our daily lives, even if it's just telling a friend that his horrible haircut "doesn't look that bad."

People tell lies and deceive others for many reasons. Most often, lying is a defense mechanism used to avoid trouble with the law, bosses or authority figures. Sometimes, you can tell when someone's lying, but other times it may not be so easy. Polygraphs, commonly called "lie detectors," are instruments that monitor a person's physiological reactions. These instruments do not, as their nickname suggests, detect lies. They can only detect whether deceptive behavior is being displayed.

Do you think you can fool a polygraph machine and examiner? In this article, you'll learn how these instruments monitor your vital signs, how a polygraph exam works and about the legalities of polygraph testing.

A polygraph instrument is basically a combination of medical devices that are used to monitor changes occurring in the body. As a person is questioned about a certain event or incident, the examiner looks to see how the person's heart rate, blood pressure, respiratory rate and electro-dermal activity (sweatiness, in this case of the fingers) change in comparison to normal levels. Fluctuations may indicate that person is being deceptive, but exam results are open to interpretation by the examiner.

Polygraph exams are most often associated with criminal investigations, but there are other instances in which they are used. You may one day be subject to a polygraph exam before being hired for a job: Many government entities, and some private-sector employers, will require or ask you to undergo a polygraph exam prior to employment.

Polygraph examinations are designed to look for significant involuntary responses going on in a person's body when that person is subjected to stress, such as the stress associated with deception. The exams are not able to specifically detect if a person is lying, according to polygrapher Dr. Bob Lee, former executive director of operations at Axciton Systems, a manufacturer of polygraph instruments. But there are certain physiological responses that most of us undergo when attempting to deceive another person. By asking questions about a particular issue under investigation and examining a subject's physiological reactions to those questions, a polygraph examiner can determine if deceptive behavior is being demonstrated.

Bonsor, K. (n.d.) Retrieved on March 17, 2013, from http://people.howstuffworks.com/lie-detector.htm