

COMPARISON OF RADIOLOGIC TECHNOLOGIST
REVIEW SYSTEM AND REGISTRY SCORES

A THESIS

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To the Provost of the Graduate School:

I am submitting herewith a thesis written by Rhonda J. Jackson entitled "Comparison of Radiologic Technologist Review System and Registry Score." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Health Sciences Instruction.

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DEDICATION

This thesis is dedicated to my mother, Earnestine Morris, for instilling me the importance of seeking your dream and to my husband, Lorenza and children, Tatia, Damon and Devon for supporting and encouraging me in the achievement of my dream.

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The purpose of this study was to determine if participation in the Abbott-Northwestern Developmental Testing Program (ANDT) improved the American Registry of Radiologic Technologist (ARRT) Examination scores of Radiologic Technologist. The study population was divided into two groups: participants and non-participants. The ANDT AND ARRT raw scores (sub-section and total) were then analyzed using a two-sample analysis. The Spearman Rank Correlation was conducted to determine the significance of this relationship.

No statistically significant difference was noted between the scores of the participants and non-participants. However, the sub-section scores for

Radiation Protection, Radiation Procedures and Patient Care and Management were significantly different for the participant group. The sub-section examination scores for Equipment Operation and Maintenance, Image Production and Evaluation were not significant.

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CHAPTER I

THE PROBLEM AND ITS BACKGROUND

Introduction

Test scores play an important role in the certification of the Radiologic Technologist. Although an individual has successfully completed an accredited program, employment at some institutions is not guaranteed. Therefore, passing scores on the American Registry of Radiologic Technologist is often the criteria used to hire or maintain a technologist.

The primary goal of a accredited school of Radiologic Technology is to help the student acquire the cognitive skills needed to achieve certification. In an effort to help the student towards this goal, several schools have begun to offer "mock" registry examinations. These examinations are thought to help the student by giving him or her some prior testing experience of the knowledge base of what is actually

covered on the registry examination. Since passing scores on the registry examination are vital to certification, it is important to investigate the role of "mock" registry examinations in successful accomplishment of the national Radiologic Technologist Registry Examination.

Statement of the Problem

The Abbott-Northwestern Developmental Testing Program is a form of "mock" registry examinations. The program is currently being used by several Radiologic Technology schools in an effort to increase the likelihood of their students achieving a passing score on the American Registry of Radiologic Technologist Examination. In order to ascertain if the use of this program does, in fact, have some impact on the passing or failure rate of the students, the following question must be answered: Is there a relationship between the American Registry of Radiologic Technology students' test scores who did and did not participate in the Abbott-Northwestern Developmental Testing Program?

Statement of the Purposes

The primary purpose of this investigation was to determine if participation in the Abbott-Northwestern Developmental Testing Program improves the American Registry of Radiologic Technology test scores of Radiologic Technologist who participated in the program. The secondary purpose was to profile the participants of the study by using an investigator-made Participant Information Survey.

Hypotheses

For the purpose of this study the following hypotheses were stated:

1. There is no significant difference between the American Registry of Radiologic Technologist test scores of those students who participated in the Abbott-Northwestern Developmental Testing Program and those who did not.
2. There is no significant difference between the American Registry of Radiologic Technologist category Radiation Protection and the similar category of the Abbott-Northwestern Developmental Testing Program test

scores of those students who participated in the Abbott-Northwestern Developmental Testing Program.

3. There is no significant difference between the American Registry of Radiologic Technologist category Equipment Operation and Maintenance and the similar category of the Abbott-Northwestern Developmental Testing Program test scores of those students who participated in the Abbott-Northwestern Developmental Testing Program.

4. There is no significant difference between the American Registry of Radiologic Technologist category Image Production and Evaluation and the similar category of the Abbott-Northwestern Developmental Testing Program test scores of those students who participated in the Abbott-Northwestern Developmental Testing Program.

5. There is no significant difference between the American Registry of Radiologic Technologist category Radiation Procedure and the similar category of the Abbott-Northwestern Developmental Testing Program test scores of those students who participated in the Abbott-Northwestern Developmental Testing Program.

6. There is no significant difference between the American Registry of Radiologic Technologist category Patient Care and Management and the similar category of the Abbott-Northwestern Developmental Testing Program scores of those students who participated in the Abbott-Northwestern Developmental Testing Program.

7. There is no significant difference between the American Registry of Radiologic Technologist total score and the Abbott-Northwestern Developmental Testing Program total score for those students who participated in the Abbott-Northwestern Developmental Testing Program.

Definition of Terms

For the purpose of this study, the terms listed below were defined as follows:

1. Abbott-Northwestern Developmental Testing Program.

A 100 question test that is distributed monthly to students whose school subscribe to the program. A total of 900 questions are administered to the program participants.

2. American Registry of Radiologic Technologist. The test that is administered to students who have completed a two-year accredited Radiologic Technology program.
3. Two-Year Accredited Radiologic Technology Program. A two year program that is accredited according to the guidelines of the American Society of Radiologic Technologist governing body.
4. Radiologic Technology Student. A student who has participated in and has graduated from a two-year Radiologic Technology program.
5. Participants. Those Radiologic Technologist students who have participated in an Abbott-Northwestern Developmental Testing Program.
6. Non-Participants. Those Radiologic Technologist students who have not participated in the Abbott-Northwestern Developmental Testing Program.
7. American Registry of Radiologic Technologist Total Score. The total score obtained by the graduate on the Registry of Radiologic Technologist.
8. Abbott-Northwestern Developmental Testing Program Total Scores. The total score obtained by the students

who participated in the program.

9. American Registry of Radiologic Technologist Category Scores. Those scores obtained by the graduate of a Radiologic Technology program on the following American Registry of Radiologic Technologist categories:

- a. Radiation Protection
- b. Equipment Operation and Maintenance
- c. Image Production and Evaluation
- d. Radiation Procedures
- e. Patient Care and Management

10. Abbott-Northwestern Developmental Testing Program Category Scores. Those scores obtained by the participant on the following Abbott-Northwestern Developmental Testing Program categories:

- a. Radiographic Processing
- b. Radiation Exposure
- c. Radiation Physics, Biology, and Protection
- d. Physics
- e. Patient Care and Management
- f. Radiographic Positioning
- g. Anatomy and Terminology

h. Special Procedures

Assumptions

The assumptions of this study included the following:

1. Both groups of the study participants were exposed to a similar curriculum.
2. The Abbott-Northwestern Developmental Testing Program measures knowledge that is also tested on the American Registry of Radiologic Technologist Examination.
3. The testing environment was similar for both groups during the testing period.
4. The Abbott-Northwestern Developmental Testing Program and the American Registry of Radiologic Technologist Examination measures cognitive elements taught in a two-year accredited Radiologic Technology program.
5. That all schools, due to their accreditation standing with the American Radiologic Technologist Board follow the curriculum suggested by the Board.

6. The categories of the Abbott-Northwestern Developmental Testing program although all are not listed as those of the American Registry of Radiologic Technologist Examination include the same content and are related in the following manner: (Abbott-Northwestern Developmental Testing Program representative Bode, 1987).

- a. The Abbott-Northwestern Developmental Testing Program categories Radiographic Processing and Radiographic Exposure relate to the American Registry of Radiologic Technologist Examination category Image Production and Evaluation and Equipment Operation and Maintenance.
- b. The Abbott-Northwestern Developmental Testing Program categories Radiation Physics, Biology and Protection relate to the American Registry of Radiologic Technologist Examination category Radiation Protection.
- c. The Abbott-Northwestern Developmental Testing Program categories Radiographic Positioning, Anatomy and Terminology, and Special Procedures

relate to the American Registry of Radiologic Technologist Examination category Radiation Procedures.

7. The self-reported American Registry of Radiologic Technology Examination scores were accurately reported by the study participants.

Limitations

The limitations of this investigation were the following:

1. Sample size will hinder generalization.
2. Participation is voluntary.
3. Inherent problems exist with the use of mail-outs surveys.

Significance of the Study

Incorporating the testing material in the course of study for Radiologic Technology students may improve Registry scores. This study might prove to be of assistance to users of the program during curriculum review as the scores on various sections of the test provide a closer look at that particular subject area. It may also provide data helpful in determining if

continued usage of such programs as the Abbott-Northwestern Developmental Testing Program is beneficial to students. As the certification process becomes more and more a criteria for the employment of Radiologic Technologist, the need for analyzing the use of such programs will be needed.

CHAPTER II

REVIEW OF RELATED LITERATURE

Competency Based Instruction

Competencies are defined as statements which identify specific skills, processes, and learning students are expected to accomplish in school. Competent practices include behaviors in three domains: cognitive, psychomotor, and affective. According to Roueche (1976), competency based instruction

. . . implies that learning produces a change in the learner's behavior i.e., the learner is able to do something new once learning has occurred. The changed learner behavior is therefore a tangible outcome of the instructional process. (p.2)

Competency based instruction encompasses the learning assumptions developed by Carroll and Bloom (1973). They held the belief that aptitude is the amount of time required by the learner to attain mastery learning of a task or competency.

Competency Based Testing and Certification

Competency based testing is a certification

mechanism whereby a student must demonstrate that he or she has mastered certain skills according to Airasian et al, (1978). These tests seek to define minimum learning outcomes for students in a variety of academic areas and to insure that standards are satisfied (Cohen and Haney, 1980).

Competencies, in most allied health care professions, are demonstrated by students first completing an accredited educational program and then by means of certification and/or licensure. Certification has been defined by Karne and Lofsness (1985) as

. . . the voluntary process by which a nongovernmental agency or association grants recognition to an individual who has met certain predetermined qualifications -- usually through passing an examination -- specified by that agency or association.
(p. 416)

The purpose of certification is to prevent incompetent persons from practicing. Certification examinations are taken seriously as to determine a students mastery of skills learned during school.

The American Registry of Radiologic Technologist
Examination

The American Registry of Radiologic Technologist

(ARRT) was founded in 1922 to establish a mechanism for assessing the qualifications of candidates for certification in Radiologic Technology. One of the primary criteria for certification is the passing of a written examination covering material felt to be necessary for safe and efficient on-the-job performance. The registry certifies candidates in three areas: radiography, nuclear medicine technology, and radiation therapy technology. According to the ARRT, the purpose of the ARRT examination in radiography is to "Access the knowledge and cognitive skills underlying the intelligent performance of the major tasks typically required of an entry-level staff technologists" (Reid, 1983).

A job analysis project conducted by Reid (1980) was begun for the purpose of documenting the linkage between typical entry-level tasks and the examination content. In the past, the registry examinations were based directly on the outline of course work described in the curriculum guideline for educational programs. The registry examinations, at that point, functioned as pure program-end achievement tests, i.e., the purpose

was to assess how well the examinees learned everything in the curriculum. The results of this project were utilized for the content development of the examination. The content of the currently used examination is divided into five categories each having a specific weight. These categories are: radiation protection, equipment operation and maintenance, image production and evaluation, radiographic procedures, and patient care and management. Students receive a category as well as total score which indicates a pass-fail status.

Test Taking Interventions

Numerous authors have stated that test taking interventions, such as test sophistication or test-wiseness, coaching, practice sessions, etc., in addition to knowledge, can affect test performance (Bajtelsmit, 1977; Dorege, 1966; Fierson, 1985; Wahlstrom and Boersma, 1968). Test-wiseness has been defined as the capacity to use features of the test and the test-taking situation during the test. Test-wiseness programs are programs aimed at increasing test-wiseness skills through a cognitive approach. It has been found

a means of reducing test-anxiety and can provide individuals with an enhanced feeling of control over the actual test situation.

The effects of coaching on test scores has been investigated. Early studies conducted by British psychologists used coaching with special reference to the practice on the test formerly used in assigning children to schools (Yates et al, 1953 & 1954). The studies found that the extent of improvement depended on the ability and earlier educational experiences of the examinees, the nature of the test, and the amount and type of coaching provided. Individuals with difficult educational backgrounds benefited more from the coaching than those with superior educational backgrounds. It was also noted that the closer the resemblance between test content and coaching material, the greater the improvement in test scores.

The College Board has conducted several studies to determine the effects of coaching on the Scholastic Aptitude Test (SAT) and has surveyed the results of other investigators (Angoff, 1971). The studies covered

a variety of coaching methods and included students in both public and private high schools. The results of the studies were that intensive drill on items similar to those on the SAT was unlikely to produce appreciably greater scores than those that occurred when students were retested after regular high school instruction. These findings differ from those of Yates, et. al. discussed above.

Test taking orientation has been used to increase scores. In studies with alternate forms of the same test, (pretest and posttest) the second score is usually higher. Significant mean gains were reported when alternate forms were administered in immediate succession or after intervals ranging from one day to three years (Angoff, 1971; Droege, 1966; Peel, 1951, & 1952). Studies have also shown that individuals with previous experience in taking standardized tests score higher than those who do not (Millman et al, 1965).

Short orientation and practice sessions were also proven to be quite effective in equalizing test sophistication in a study done by Wahlstrom and Boersman (1968). It was assumed that a degree of

knowledge about content material and ability to apply test-wiseness principles were highly related. The study done by Wahlstrom and Boersman (1968) found that;

Granted, the teaching of test-wiseness principles will not remove all variation in test scores due to differential test sophistication, but it will, in all probability reduce the source of error variance in observed scores. (p. 416)

In Wahlstrom's and Boersman's (1968) early study, 117 students from ninth grade classes were randomly assigned to six groups; two control, two experimental, and two placebo. Each of the groups received social study pretest and posttest. Wahlstrom and Boersman found the differences between the pretest and posttest mean score for the control and placebo groups to be nonsignificant. However, the experimental group was found to score significantly higher.

A study done by Bajtelsmit (1977) further supports the results of Boersma's study. The study sought to evaluate the effectiveness of test-wiseness (TW) and systematic desensitization (SD) programs, administered separately and together. The groups, composed of adults

the test-wiseness and systematic desensitization treatments, were compared to a control group receiving no treatment. Differences were evaluated using measures of test-wiseness, anxiety, and performance. The design used by Bajelsmit (1977) attempted to approximate reality by carefully selecting subjects, eliminating pretests, minimizing experimental reactivity, and by distributing real-life treatments in a realistic manner. The study found that;

Although reduced power rendered the reliabilities of the observed treatment differences difficult to confirm, their directionalities were generally consistent with a-priori exception and seem to suggest findings of great significance. (p. 339)

Specifically, the study indicated a passing mean for both systematic groups and roughly twice the percentage of passes in the intervention groups as in the control group.

Frierson (1964) also used a testing intervention approach to test taking. The procedure was done in an effort to enhance a class of medical technologist performance on the American Society of Clinical Pathologist (ASCP) Registry Examination for Medical

Technologist. In the study, a class receiving intervention was compared with two other groups of medical technologist. The three components of the intervention used were: effective test taking instruction procedures, practice and feedback and self-assessment, and self-directed learning procedures.

The aims of the intervention procedure were to: (1) teach effective test taking techniques, (2) provide reinforcement through practice and feedback, and (3) introduce the use of self-assessment procedures to help students determine areas of strengths and weaknesses. (p. 228)

The results of the study indicated that the employed interventions significantly influenced the registry examination performance of the group that received the intervention.

Predicting Scores

This section will deal with the mechanisms that have previously been used to predict scores. Several studies in this area have been conducted primarily in the medical and nursing areas concerning using certain criteria to predict a student's performance in school, job, registry scores, etc. In most studies grade point

averages (GPAs) have been used as a predictor in professional programs.

A study conducted by Richard (1972) used the National League of Nursing Achievement Test in addition to nursing GPAs and clinical GPAs to predict test scores. The study showed correlations of varying degrees between the State Board Test Pool Examination (SBE) and the National League of Nursing Achievement (NLN) tests scores, nursing GPA, and clinical GPA. Similar results were discovered in studies by Bell and Martindell (1976); Brandt, Hastic, and Schumann (1966) and Muhlenkamp (1971). All these studies found the highest correlation to be between NLN and SBE scores.

Tidd and Conine (1972) conducted a study of 285 physical therapy graduates. They investigated correlations between program courses, biological sciences, clinical performance, and academic GPA. High correlations between academic GPA and preprofessional GPA ($r = .80$), and between academic GPA and physical therapy courses ($r = .73$) were recorded. An unpublished 1976 study conducted by Stewart investigated correlations between entrance criteria and program

performance of 22 medical laboratory technician students. Of the factors investigated the only significant correlation, as in previous studies, was found to be between high school GPA and the college GPA ($r = .65$).

A study conducted by Blagg (1985) used other indicators to predict selected graduate allied health students' success. The purpose of the study was to determine whether cognitive-style and learning-style variables were predictive of success in a graduate allied health education program. In the study three cognitive-style measures were used to assess integrative complexity, dogmatism, and field-independence-dependence. The population consisted of 51 students who had taken the comprehensive examination for the Master of Education in Allied Health Education between the years 1980 and 1983. The population consisted of representatives from the following disciplines: medical technology, physical therapy, occupational therapy, respiratory therapy, cytotechnology, histotechnology, physician assistant, and health education. The results indicated that there

was no significant relationship between academic success and the cognitive-style variables. However, a stepwise multiple regression indicated that 20.44% of the Master's Comprehensive Examination (MCE) and 41.36% of the variance on the essay portion of the MCE were explained by learning-style variables.

Predictive studies involving radiologic technology education in the past have focused mainly on criteria used in admissions and curriculum decisions. Kavanagh (1981) was concerned with predictors of success in specific allied health programs. The GPA from high school records and selected program courses of 30 radiologic technology students were compared to determine: (1) What should be used as criteria for admission?, and (2) If there was a relationship between admission criteria and subsequent performance in program courses? The findings of the study indicated that: (1) correlations between high school algebra and biology and program counterparts were significant to continue to use as admission criteria, (2) there was a high correlation between achievement in college mathematics, and radiation physics, and (3) correlations between physics

and principles of exposure ($r = .69$) indicated that students who performed well in physics also achieved well in principles. The results of the study appeared to be consistent with other studies that cited GPA as a valid indicator of success in post-secondary achievement and in passing the registry examination.

A further predictive study by Lauer (1981) was conducted to determine the effect of selected factors on the radiologic technology students and their performance on the registry examination. The study found no relationship between six manipulable factors (educational expertise of the faculty; institutional academic degree requirements; the number of clinical education hours required; methods used in assigning students to clinical affiliates; the use of on-campus energized laboratories; and the use of a registry preparation and review used in college based programs) and registry scores of radiologic technology students from these programs. The findings of the study indicated that among those programs studied no significant correlations were obtained between mean program registry scores and the six manipulable factors

used in the study. Lauer found that regardless of the ways in which these factors were implemented among those programs studied, students had an equal chance for success on the registry examination.

A further study by Macomber and Sanders (1981) found that performance on a simulated registry and GPA proved to be statistically significant predictors of students success on the registry examination. The study conducted by Macomber and Sanders (1981) used a simulated registry ("mock" registry) and the GPA of students to predict the student's scores. In the study, with a population of 105 radiologic technologist students, the strongest correlation was between the registry examination scores and the simulated registry scores ($r = .69$). The results of the t -test on the simulated registry and GPA were found to be marginally significant.

The Abbott-Northwestern Developmental Testing Program

The Abbott-Northwestern Developmental Testing Program (ADNT) is a 100 question test that is distributed monthly to schools of radiology who are

subscribers to the program. The test design is one of a "mock" or simulated examination. It is also a means of progressively testing the student throughout the program. The objective of the test is to provide measurement, on a national basis, of student's progress through training. The program, developed by the Abbott-Northwestern Hospital School of Radiology Technology in 1972, has cited among its goals;

To provide students with a true test of their knowledge by allowing their instructors to track their learning on a month to month basis. To help determine a student's strengths and weaknesses by dividing the test into distinct categories. (p. 1)

The program provides interpretation of the student's raw score, raw percentage, scaled standard, and rank. It also provides nationwide comparisons of: high and low scores, means, standard deviations, number of students taking the test, and KR 21 (reliability). Thus, letting the student see how she or he ranked nationwide. The program has been utilized by several Radiologic Technology schools in an effort to test skills, both clinical and didactic, taught in their programs. It has also been used to serve as a review

for the registry examination.

Summary

While review of related literature revealed little information about a progressive testing system incorporated in the curriculum of the radiologic technology student, there has been considerable work done using testing interventions of some type and the validity of using scores, GPAs, etc. to predict success. Using effective test taking procedures to reduce unwarrantable errors provides students with knowledge needed to answer an item correctly. The aims of such a procedure are to teach test taking techniques, provide reinforcement through practice and feedback and help students determine areas of strengths and weaknesses.

Test performance, in general, plays a significant role in determining the individual's educational success. Test performance for the radiologic technology students, as in most health care areas, is crucial to licensure and/or certification. A recognized phenomenon and concern is that test-wiseness can affect test performance. Predictive studies have also indicated

that a student's success can be predicted based on previous GPAs and other course scores. With the use of test-wiseness programs, as indicated by the results of several researchers, one may be able to predict the success of the student.

CHAPTER III

PROCEDURES OF THE STUDY

Introduction

This study was conducted to investigate the relationship between the registry review scores of radiologic technology students who did and did not participate in the Abbott-Northwestern Developmental Testing Program. A ex post facto research design was utilized. A static group comparison of two non-randomized groups was used in this descriptive study. This chapter specifies the population and sample, discusses the instruments used, data collection methods, and how the data were treated.

Population and Sample

A list obtained from the Abbott-Northwestern Developmental Testing Program provided names of schools who had participated in their program. From the provided list schools were conveniently selected to participate in the study as participants (those who had

participated in the Abbott-Northwestern Developmental Testing Program). Students located in Texas and some who were educated in Midwestern states, Kansas and Iowa, were chosen by convenience to participate in the study as non-participants (those who had not participated in the Abbott-Northwestern Developmental Testing Program). All programs selected had to meet the criteria of being a two or four year program that was accredited by the American Board of Radiologic Technologist and taught according to the curriculum guidelines set forth by the Board and all participants and non-participants must have participated in such a program. A total of seven programs were contacted.

Selection of Participants

Due to the sensitive nature of radiologic technology review scores, more than one strategy had to be used in order to obtain an acceptable number of subjects. The population of this investigation included those radiologic technology students who did and did not participate in the Abbott-Northwestern Developmental Testing Program. Program Directors were contacted via

telephone or mail in order to obtain a list of addresses and telephone numbers of all students who did and did not participate in the Abbott-Northwestern Developmental Testing Program. Only those names of students who had taken the American Registry of Radiologic Technology Examination within the last three (3) years were asked to be included on the list. The lists were used to contact the students by mail or by telephone. A total of 34 participants and 48 non-participants were contacted, resulting in a total of 82 contacts.

Protection of Human Subjects

The survey research was exempt from review by the University's Human Subjects Review Committee. No individual or institution was identified by name and all information was reported as group data. The participants were informed that participation in the study was voluntary and that the return of the answered survey tool denoted consent.

Instrument

The instrument used in this investigation was a researcher-designed survey tool. This survey tool

consisted of information which was only used for profiling purposes. A section on the survey tool was provided in order to conveniently record the scores received by the radiologic technologist on the American Registry of Radiologic Technologist Examination (see Appendix D). The scoring sheets of the Abbott-Northwestern Developmental Testing Program as well as some scoring sheets of the American Registry of Radiologic Technologist Examination that were provided by the participants were also used in the study.

Reliability and Validity

The investigator-made survey tool was only used for profiling purposes and as such did not require that a reliability or validity study be done. According to the Abbott-Northwestern Developmental Testing Program (1985) the reliability of the program was determined using the Kuder-Richardson formula 21 (KR 21). KR 21 levels were maintained at approximately .90. Validity was obtained from the mean, standard deviation, and KR 21 for each score. The mean maintained at 60, the average standard deviation was 14.5 and the KR 21 was maintained at

approximately .90. According to the American Registry Of Radiologic Radiography (1983) the reliability of the registry examination was reported as typically falling between a KR 20 value of .90 and .95 for the various forms of the examination. The validity was typically assessed using a content validity approach and did not result in a specific number.

Data Collection

A personal packet was developed for each participant. The packet contained a cover letter, an instrument, and a pre-addressed stamped envelope (see Appendix D). A total of 45 envelopes were mailed by the investigator.

Ten days were allowed to complete the survey tool, after which each participant received a follow-up letter which included another questionnaire and pre-addressed stamped envelope. If the second request for information was not returned within fourteen (14) days, it was not included in the study. At the end of the time, there was still not enough surveys returned to conduct the study. Therefore, the investigator contacted the

participants again and extended the time to an additional three (3) weeks in order to increase the study's population. If the participants had participated in the Abbott-Northwestern Developmental Testing Program their Radiologic Technology program director was then contacted for their Abbott-Northwestern Developmental Testing Program scores only (see Appendix B).

Treatment of Data

A computer-assisted analysis of the data collected was conducted. The Exu*Stat* package for statistical analysis was used.

For the study, the participants were divided into two sample groups with Group 1 being participants and Group 2 being non-participants for the purpose of testing the null hypothesis. The Group 1 or participants scores were further broken into two sub-groups; A & B. Sub-group A was the participants' registry examination total or sub-section scores and sub-group B was the participants' Abbott-Northwestern Developmental Testing Program sub-section or total

scores. The mean for each section and total score was computed from the report of each participants' monthly Abbott-Northwestern Developmental Testing Program scores. This was done in order to test hypotheses 2 through 7.

Descriptive statistical tests involving frequency and percentage were performed on the demographic variables. Each hypothesis was addressed in the following manner: the registry examination and Abbott-Northwestern Developmental Testing Programs scores of those students who did participate and those who did not were noted. The scores were converted into t scores and then a two-sample analysis was performed. The obtained t score was compared with a critical value at a point .05 level. A series of t-tests were conducted on the sub-section and total scores with a corrected alpha level of .044.

In order to further strengthen the hypothesis testing and conclusions of this study, a Spearman Coefficient Rank of Correlations was performed on the participants of the Abbott-Northwestern Developmental

Testing Program sub-section and total scores and the American Registry of Radiologic Technologist Examination sub-section and total scores. The test was chosen because it was accessible to the researcher.

CHAPTER IV

FINDINGS OF THE STUDY

Introduction

A description of the subjects and the study results are reported in this chapter. The results are presented in the following manner; (1) demographic parameters of the study population, and (2) data analysis relating to hypothesis acceptance or rejection.

Sample Participants

Twenty-one Radiologic Technologist who had participated (hereafter referred to as participants) in the Abbott-Northwestern Developmental Testing Program and 23 Radiologic Technologist (hereafter referred to as non-participants) who had not participated in the Abbott-Northwestern Developmental Testing Program participated in the study. Originally 82 Radiologic Technologist were contacted by mail or telephone; 34 participants and 48 non-participants. Two of the non-participants who returned their form choose not to

participate in the study. Five forms were returned in the mail as a result of unknown forwarding addresses. Two forms were returned incomplete and as a result were not used in the study. The remaining 29 forms were not returned.

Demographic Profile

Demographic characteristics of these subjects' included: age, sex, educational background, current employment status and length, and employment and marital status during educational/training period. Subjects were also asked, if they indicated on the form that they had participated in the Abbot-Northwestern Developmental Testing Program, if their participation was voluntary. This information was obtained from the Participants Informational Survey and Agreement Form.

Approximately 56% of the participants were females and 45% were males. The participants' ages ranged from 23 to 35 with the mean age being 29.3. Fifty-nine percent or 26 of those responding graduated from a 2 year junior college radiologic technology program, while approximately 40% graduated from a two year hospital-

based radiologic technology program and only 0.4% graduated from a 4 year program. Eighty-four percent of the survey respondents were currently employed with employment ranging from 6 months to 3.5 years. Thirty percent of those responding were employed during their educational/training period and only 23% were married during this period. Of those who had participated in the Abbott-Northwestern Developmental Testing Program only 10% did so on a voluntary basis.

Findings by Hypotheses

Hypothesis 1 stated, "there is no significant difference between the American Registry of Radiologic Technologist test scores of those students who participated in the Abbott-Northwestern Developmental Testing Program and those students who did not." The t-test revealed that there is no significant difference between each sub-section (Radiation Protection, Equipment Operation and Maintenance, Image Production and Evaluation, and Patient Care and Management) and total score of the American Registry of Radiologic Technologist of those students who participated and

those who did not. Therefore, the null hypothesis was not rejected. Data shown in table 1 illustrates the difference between the total and sub-section scores.

Hypotheses 2 through 7 focused on the Abbott-Northwestern Developmental Testing Program and American Registry of Radiologic Technologist Examination sub-section and total scores of those students who participated in the program. Findings of each hypotheses follows (see table 2).

Hypothesis 2 stated, "there is no significant difference between the American Registry of Radiologic Technologist Examination category Radiation Protection sub-section score of those students who participated in the Abbott-Northwestern Developmental Testing Program and the similar category of the Abbott-Northwestern Developmental Testing Program." Based on the t-test score of -7.36 and significance level of $<.0001$, the null hypothesis was rejected.

Hypothesis 3 stated, "there is no significant difference between the American Registry of Radiologic Technologist Review Examination category Equipment Operation and Maintenance and the similar category of

TABLE 1
COMPARISON BETWEEN AMERICAN REGISTRY OF RADIOLOGIC
TECHNOLOGIST EXAMINATION SCORES OF PARTICIPANTS
AND NON-PARTICIPANTS

Sections	Group 1		Group 2		t-score	Degree of Freedom	Sig. Level
	Mean	S.D.	Mean	S.D.			
Radiation Protection	83.6	6.6	81.6	7.3	.92	37.6	>.05
Equipment Operation and Maintenance	83.6	9.4	83.6	6.1	.01	32.6	>.05
Image Production and Evaluation	81.7	7.9	82.2	6.4	.21	36.5	>.05
Radiation Procedures	82.3	7.0	82.6	5.8	.12	36.7	>.05
Patient Care and Management	80.6	8.5	83.8	7.1	-1.30	36.8	>.05
Total Score	82.1	7.3	82.8	6.1	-.30	36.8	>.05

Key: Group 1 = Participants
Group 2 = Non-Participants

the Abbott-Northwestern Developmental Testing Program sub-section scores of those students who participated in the Abbott-Northwestern Developmental Testing Program." A t-score of -10.68 and a significance level of $<.0001$ resulted in the rejection of this hypothesis.

Hypothesis 4 stated, "there is no significant difference between the American Registry of Radiologic Technologist Examination category Image Production and Evaluation and the similar category of the Abbott-Northwestern Developmental Testing Program sub-section scores of those students who participated in the Abbott-Northwestern Developmental Testing Program." Based on a t-score of -8.31 and a significance level of $<.0001$, the null hypothesis was rejected.

Hypothesis 5 stated, "there is no significant difference between the American Registry of Radiologic Technologist Examination category Radiation Procedures and the similar category of the Abbott-Northwestern Developmental Testing Program sub-section scores of those students who participated in the Abbott-Northwestern Developmental Testing Program." The t-score of -9.65 and a significance level of $<.0001$

resulted in the rejection of the null hypothesis.

Hypothesis 6 stated, "there is no significant difference between the American Registry of Radiologic Technologist Examination category Patient Care and Management and the similar category of the Abbott-Northwestern Developmental Testing Program." Based on a t-score of -8.14 and a significance level of $<.0001$, the null hypothesis was rejected.

Hypothesis 7 stated, "there is no significant difference between the American Registry of Radiologic Technologist Examination total score and the Abbott-Northwestern Developmental Testing Program total score of those students who participated in the Abbott-Northwestern Developmental Testing Program." A computed t-score of -10.53 and a significance level of $<.0001$ resulted in the rejection of the null hypothesis.

Findings of Spearman Rank Correlations

The Spearman Coefficient Rank of Correlations was performed on the participants Abbott-Northwestern Developmental Testing Program sub-section and total scores and the American Registry of Radiologic

TABLE 2

COMPARISON OF AMERICAN REGISTRY OF RADIOLOGIC TECHNOLOGIST
AND ABBOTT-NORTHWESTERN DEVELOPMENTAL TESTING PROGRAM
SCORES OF STUDENTS WHO PARTICIPATED IN THE STUDY

Sections	A		B		t-score	Degree of Freedom	Sig. Level
	Mean	S.D.	Mean	S.D.			
Radiation Protection	54.7	14.5	81.6	7.4	-7.4	28.2	<.0001
Equipment Operation and Maintenance	54.9	10.3	83.6	6.1	-10.7	30.9	<.0001
Image Production and Evaluation	54.7	13.3	82.2	6.5	-8.3	27.5	<.0001
Radiation Procedures	60.4	8.4	82.6	5.8	-9.7	33.8	<.0001
Patient Care and Management	51.3	16.4	83.8	7.1	-8.1	25.9	<.0001
Total Score	55.2	9.9	82.8	6.1	-10.5	31.5	<.0001

Key: A = Abbott-Northwestern Developmental Testing Program Scores
B = American Registry of Radiologic Technologist Test Scores

Technologist Examination (see table 3). Based on these findings there was statistically significance between the sub-section scores for the American Registry of Radiologic Technologist Examination categories Radiation Protection, Radiation Procedures, and Patient Care and Management and the similar categories of the Abbott-Northwestern Developmental Testing Program. The results of the Spearman Rank Correlation also showed that the relationship between the American Registry of Radiologic Technologist Examination categories Equipment Operation and Maintenance, Image Production and Evaluation, and the total score and the similar categories and total score of the Abbott-Northwestern Developmental Testing Program was not statistically significant.

Summary

The study population was described in terms of the subjects' age, sex, educational background, current employment status and length of employment, and employment and marital status during their educational/training period.

There were seven hypotheses which were dealt with

TABLE 3
SPEARMAN RANK CORRELATION OF AMERICAN REGISTRY OF
RADIOLOGIC TECHNOLOGIST REVIEW EXAMINATION AND
ABBOTT-NORTHWESTERN DEVELOPMENTAL TESTING PROGRAM

Sections	Estimated Coefficient	Score	Significant
Radiation Protection	.43	.05	Yes
Equipment Operation and Maintenance	.32	.15	No
Image Production and Evaluation	.27	.23	No
Radiation Procedures	.43	.05	Yes
Patient Care and Management	.49	.02	Yes
Total Score	.30	.07	No

in the study. Mean scores and standard deviations were identified for the sub-section and total test scores of specific groups. The disposition of the hypotheses is in table 4.

TABLE 4
DISPOSITION OF NULL HYPOTHESES

HYPOTHESES	DISPOSITION
1. There is no significant difference between the American Registry of Radiologic Technologist test scores of those students who participated and those who did not participate.	Accepted
2. There is no significant difference between the American Registry of Radiologic Technologist category Radiation Protection and the similar category of the Abbott-Northwestern Developmental Testing Program test scores of students who participated in the Abbott-Northwestern Developmental Testing Program.	Rejected
3. There is no significant difference between the American Registry of Radiologic Technologist category Equipment Operation and Maintenance and the similar category of the Abbott-Northwestern Developmental Testing Program test scores of students who participated in the Abbott-Northwestern Developmental Testing Program.	Rejected

DISPOSITION OF NULL HYPOTHESIS {CONT.}

- | | | |
|------|---|----------|
| 4. | There is no significant difference between the American Registry of Radiologic Technologist category Image Production and Evaluation and the similar category of the Abbott-Northwestern Developmental Testing Program test scores of students who participated in the Abbott-Northwestern Developmental Testing Program. | Rejected |
|
 | | |
| 5: | There is no significant difference between the American Registry of Radiologic Technologist category Radiation Procedures and the similar category of the Abbott-Northwestern Developmental Testing Program test scores of students who participated in the Abbott-Northwestern Developmental Testing Program | Rejected |
|
 | | |
| 6: | There is no significant difference between the American Registry of Radiologic Technologist category Patient Care and Management and the similar category of the Abbott-Northwestern Developmental Testing Program test scores of students who participated in the Abbott-Northwestern Developmental Testing Program. | Rejected |
|
 | | |
| 7: | There is no significant difference between the American Registry of Radiologic Technologist total test score and the total test score of the Abbott-Northwestern Developmental Testing Program test score of students who participated in the Abbott-Northwestern Developmental Testing Program. | Rejected |

Note: The .05 level of significance was used.

CHAPTER V

SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Summary

The purposes of this study were to: (1) determine of participation in the Abbott-Northwestern Developmental Testing Program improved the American Registry test scores of Radiologic Technologist participants in the program, and (2) profile the participants of the study using an investigator-made Participant Informational Survey. Packets containing the survey were mailed to Radiologic Technologist who as students had participated in the Abbott-Northwestern Developmental Testing Program as well as those who had not. Participants in the Abbott-Northwestern Developmental Testing Program program directors were contacted for these scores. A computer-assisted analysis of the data collected was conducted using the Exu*stat* statistical analysis package. The participants of the study were divided into two sample groups with Group 1 being participants and Group 2

being non-participants. The Group 1 was further broken into two sub groups; A and B. A two-sample analysis was performed using the means scores, degrees of freedom, and standard deviation to determine any significant differences in the scores of the participants. Significance was set at the .05 level for each hypotheses. A corrected alpha level for hypotheses 2 through 7 was set at .044. Hypothesis 1 was accepted and the remaining hypotheses, 2 through 7, were rejected as a result of each finding. The disposition of the null hypotheses for the total study group is included in table 4.

Conclusion

The findings of this study lead to the following conclusions relative to the correlation between Radiologic Technologist review system test scores and registry scores.

1. There was no statistically significant difference between the scores of those students who participated in the Abbott-Northwestern Developmental Testing Program and those who did not.

2. There were no statistically significant differences between each sub-section score on the Abbott-Northwestern Developmental Testing Program and the American Registry of Radiologic Technologist Examination sub-section scores of those students who participated in the Abbott-Northwestern Developmental Testing Program.

3. There were significant correlations between sub-section scores for the American Registry of Radiologic Technologist Examination categories Radiation Protection, Radiation Procedures, Patient Care and Management and the similar categories of the Abbott-Northwestern Developmental Testing Program. This relationship was statistically significant (see table 3).

4. There was a significant correlation between sub-section scores for the American Registry of Radiologic Technologist Examination categories Equipment Operation and Maintenance, Image Production and Evaluation, and the total score and the similar categories and total score of the Abbott-Northwestern Developmental Testing Program. However, this

relationship was not statistically significant (see table 3).

Discussion

There are several findings and observations relative to this study which warrant discussion. The most important of these is that the relationship between the scores of 23 students who participated in the Abbott-Northwestern Developmental Testing Program was a direct one. Therefore, indicating that one could predict their scores on the registry examination based on the scores they received on the Abbott-Northwestern Developmental Testing Program. Also, prior test knowledge or test-wiseness can play an important role in predicting scores.

Another observation is the fact a vast majority of Radiologic Technologist are reluctant to report their scores due to the confidential nature of scores. This fact, that those who participated volunteered to do so, may have limited the scope of the study due to the limited amount of respondents. Voluntaryism also may have impacted the research to the extent that it may

have biased the result of the study in other areas.

The majority of participants who participated in the Abbott-Northwestern Developmental Testing Program volunteered to do. Some unsolicited comments were: (1) "that we (the students) did not receive all scores or a breakdown and understanding of the scores (Abbott-Northwestern Developmental Testing Program scores)," (2) "the Abbott-Northwestern Developmental Testing Program was a big disappointment," and (3) "the test (Abbott-Northwestern Developmental Testing Program) did not seem to correlate with the real registry (American Registry of Radiologic Technologist Examination)." These students participation in the program was mandatory. Other unsolicited comments praised the program stating "it was a great help in passing the American Registry of Radiologic Examination." It is interesting to note that these comments came from students who volunteered to participated. The fact, that only a small percentage of those students participating in the program volunteered and as is noted by the comments of those who did not volunteer, may suggest that this (voluntaryism) could possibly have some bearing on the effectiveness of such

programs. Having to pay for a program that one volunteers for may also effect the way one perceives the effectiveness of such a program. Although the program was included in the course of study for those students who participated, the cost for the program was passed on to the students. This may also result in the program not being used to its fullest extent. Perhaps better students participated on a volunteer basis because they see the benefit (passing the registry examination) of doing so.

It was found that raw scores of those who participated were only slightly higher than those who did not participate in the Abbott-Northwestern Developmental Testing Program. However, the investigator is unable to provide a complete explanation for this phenomena. It is possible that other methods of review were used in the programs of those who did not participate in the Abbott-Northwestern Developmental Testing Program resulting in passing scores. Also, students who are high achievers, may have seen the need to participate in some type of review program whether it

was offered by the school or not. The scores of those who participated may have been effected by the studying that occurred for the Abbott-Northwestern Developmental Testing Program monthly tests. Also when tests and scores were returned to these students, they served as a further review of the material. Therefore, allowing the students another opportunity to learn the material.

The information gained from this study could be used when a Radiologic Technology school and/or program is determining mock boards or simulated test situations to incorporate when seeking to increase the registry examination scores of their students. The content and/or test questions of such programs, when properly utilized, can help identify areas of strengths and weaknesses of the students as well as the program curriculum. It can also serve as a means of identifying the appropriate objectives to include in select courses. A student found to be deficient in a particular area can be provided with the necessary practice and/or additional instruction to assure success on the registry examination.

As several studies have shown test-wiseness does

play an important role in predicting success or failure. The incorporation of the Abbott-Northwestern Developmental Testing Program or some similar program would be of value to Radiologic Technologist students. Although the program alone will not guarantee success, it will provide the student with an assessment of their knowledge base which may increase their probability of being successful on the registry examination.

Recommendations

Based upon the results of this study the following recommendations are:

1. to conduct a replicate study using a greater number of subjects.
2. to conduct a replicate study using students who graduated from Radiologic Technology programs since 1980.
3. to conduct a study which correlated more than one testing program.
4. to conduct a study comparing the use of a progressive review system versus a one-time review session and the effects, if any, it may have on the

registry examination scores.

5. to conduct a study comparing the scores of students who volunteered to participate in such program and those who did not.

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APPENDIXES

APPENDIX A

**Letter to Schools on Abbott-Northwestern Developmental
Testing List Requesting Names of Participants**

Rhonda Jackson
2117 Trinidad
Dallas, Texas 75232

Dear Program Director;

I am sure that you are aware of the fluctuation in test scores received by Radiologic Technology students on the Registry examination. This fluctuation has long been a concern as well as of interest to me.

I hope to discover, through a research study, if the Abbott-Northwestern Developmental Testing Program you are currently using with your students increases the passing rates and/or scores of your students. Hopefully, this study will provide some insight into any needed revision of curriculums. The feasibility of such a testing program may also be addressed through the study.

In order to complete the study, I will need some information from you concerning your school and its students. I would appreciate your forwarding the following information.

1. The names and addresses of those students who participated in the Abbott-Northwestern Developmental Testing Program during their training within the last three (3) years.
2. The names and addresses of those students who did not participate in the Abbott-Northwestern Developmental Testing Program during their training within the last three (3) years.

I would appreciate your forwarding the information within the next 10-15 days in the enclosed stamped pre-addressed envelope as it is vital to the success of the study. Your school will not be identified by name nor will the names of the students. If you would like a copy of the findings of the study, please indicate this in your letter.

If you have any questions and/or concerns, please contact me at the above address or call me at (214) 330-8832 after 6:00 pm.

Thanking you in Advance,

Rhonda J. Jackson B.S.R.T. (R)
Texas Woman's University Graduate Candidate

APPENDIX B

Letter to Directors Requesting Scores

Rhonda Jackson
2117 Trinidad
Dallas, Texas

Dear:

I am currently conducting a research study involving the usage of the Abbott-Northwestern Developmental Testing Program. I am aware that your school has participated in this program in the past. In fact, two of your past students have agreed to participate in the study by providing their registry scores. However, for me to include them in the study, I will need their scores on the Abbott-Northwestern Developmental Testing Program (both category and total).

I would appreciate you forwarding these scores and have enclosed a pre-addressed stamped envelope for this purpose alone with a copy of the student's agreement to participate.

If you would like, I will be happy to send you an abstract of my study once it is completed. Hopefully it can serve as an evaluative tool for further use of the testing program and aide you in future curriculum decisions. If you have any questions or concerns, please feel free to contact me at the above address or call me at (214)330-8832 after 6:00 pm.

Thank you in advance for your cooperation.

Sincerely,

Rhonda Jackson B.S.R.T. (R)
Texas Woman's University Graduate Candidate

APPENDIX C

Letter to Technologist and Participants Informational
Survey and Agreement Form

Rhonda Jackson
2117 Trinidad
Dallas, Texas 75232

Dear:

I am sure you are aware of the fluctuation in Registry scores received by Radiologic Technology students. This fluctuation has long been of concern as well as interesting to me.

I hope to discover through research if a selected developmental testing program has any effect on registry scores. In order to complete the study I will need scores (including section scores) from students who have and have not participated in a program of this nature. I am aware of the confidential nature of registry scores and will therefore not identify you by name or school.

The return of the attached form, should you agree to participate, will comply consent in the research program. Please complete and return the form even if you do not wish to participate. However, it is my hope that you will participate in the study. I have enclosed a stamped pre-addressed envelope for this purpose.

If you would like an abstract of my findings after the study is completed, please indicate this in the appropriate space on the form (include your address).

If you have any question and/or concerns, please feel free to contact me at the above address or call me at (214)330-8832 after 6:00 pm.

Thank you in advance.

Rhonda Jackson
Texas Woman's University Graduate Candidate

Participants Informational Survey and
Agreement Form

Name: _____

Signature: * _____
(* signature denotes consent)

Address: _____

Please answer the following questions by placing a (X)
in the appropriate space.

I will participate in your study

_____ Yes _____ No

1. Age: 17-22 _____ 23-35 _____

 36-40 _____ over 40 _____

2. Sex: Male _____ Female _____

3. Educational background (please check ALL statements
that apply to you).

Graduated from 2 year hospital-based program _____

Graduated from 2 year junior college program _____

Graduated from 4 year college program _____

Had some college before entering program _____

Had no college before entering program _____

4. Employed: Yes _____ No _____

Length of Employment: _____

5. The following questions relate to your status during
your radiologic technology educational/training period.

Employed: Yes _____ No _____

Married: Yes _____ No _____

Please circle the appropriate response.

7. I have / have not participated in the Abbott-Northwestern Developmental Testing Program.

If you have participated in this program, your school will be contacted for those scores only. The name of the school nor your name will be used in the study. Please complete the following section in order for your school to be contacted.

Name of School _____

Director of Program _____

Address _____

8. If you participated in the developmental program was it voluntary?

Yes _____

No _____

Please fill in your registry scores

Section A: _____

Section D: _____

Section B: _____

Section E: _____

Section C: _____

Total Score: _____

Thank you for your time and cooperation

Rhonda Jackson
2117 Trinidad
Dallas, Texas

APPENDIX D
Follow-up Letter

Rhonda Jackson
2117 Trinidad
Dallas, Texas

Dear:

About two weeks ago a letter seeking your registry scores was mailed to you. As of today, I have not received your response.

If you have already completed and mailed the form to me, please accept my sincere thanks. If not, please do so today. Because of the limited number of available responses, it is extremely important that your scores be included in the study.

In the event that your form has been misplaced, a replacement is enclosed. Your contribution to the success of this study will be greatly appreciated.

Sincerely,

Rhonda Jackson, B.S.R.T. (R)
Texas Woman's University Graduate Candidate