

**STUDENTS PERCEPTIONS OF A RELATIONSHIP BETWEEN
YOUNG ADULT FICTION AND SCIENCE LITERACY**

CELIAMARIE NARRO

Department of Teacher Education

APPROVED:

Sally Blake, Ph.D., Co-Chair

Milagro Seda, Ph.D., Co-Chair

John Daresh, Ph.D.

Charles H. Amber, Ph.D.
Dean of the Graduate School

**STUDENTS PERCEPTIONS OF A RELATIONSHIP BETWEEN
YOUNG ADULT FICTION AND SCIENCE LITERACY**

By

CELIAMARIE NARRO, M.Ed.

THESIS

Presented to the faculty of the Graduate School of

The University of Texas at El Paso

in Partial Fulfillment

of the Requirements

For the Degree of

MASTERS OF ARTS

Department of Teacher Education

THE UNIVERSITY OF TEXAS AT EL PASO

July 2004

UMI Number: EP10801

PREVIEW

UMI[®]

UMI Microform EP10801

Copyright 2005 by ProQuest Information and Learning Company.
All rights reserved. This microform edition is protected against
unauthorized copying under Title 17, United States Code.

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

DEDICATION

This thesis is dedicated to Dr. Sally Blake, whom without it would have not become a reality.

ACKNOWLEDGEMENTS

First and foremost I would like to thank my savior Jesus Christ for without Him I am nothing. To my supportive family my mother Ruth L.Narro, my grandparents Miguel H. Narro, and Julia Narro along with Celia Elias, and Leonor Elias thank you for your love, encouragement and support. To my best friend Nia Salazar I appreciate you for keeping me on task, and motivating, as well as for your love and driving me on those early Saturdays.

A special thank you to Dr. Sally Blake my guardian angel sent from God who guided me and dedicated her time to assure my success in this thesis. I would also like to thank Dr. Milagro Seda and Dr. John Daresh for being members on my thesis committee and for their guidance.

Finally, my gratitude to Mrs. Gloria Ontiveros for allowing me to conduct the research in her class. Thank you for your enthusiasm and input without you willing to participate in the study this thesis would have never come to pass.

This thesis was submitted to the committee on July 19, 2004

Students Perceptions of a Relationship Between Young Adult Fiction and Science Literacy

ABSTRACT

The purpose of this study is to determine if there is a relationship between young adult fiction and middle school scientific literacy. Students participating in the study will complete pre and post science knowledge tests, self-efficacy surveys designed to investigate the student's perspective of his/her science knowledge levels prior to and upon reading completion of a science fiction book. The participating teacher will also complete similar surveys to determine his/her perceptions in relation to student's scientific inquiry and literacy levels. SPSS 12.0 for windows will be used to evaluate the data, performing the statistically significant method of Analysis of variance (ANOVA): simple repeated measures, measuring scores two or more times on a dependent variable. The statistical analysis of this study is to determine if a mean difference between the two populations exists and whether to accept or reject the null hypothesis H_0 :

H_0 : Introducing science fiction literature into a 8th grades student's science curriculum will have no impact on the student's scientific literacy level

In rejecting the null hypothesis the data does demonstrate that there is An apparent relationship of possible significance between Young Adult Fiction and middle school scientific literacy, providing evidence for the need of additional research to be conducted.

TABLE OF CONTENTS

DEDICATION.....	iii
ACKNOWLEDGEMENTS	iv
ABSTRACT.....	v
LIST OF TABLES	vi
CHAPTER 1 INTRODUCTION.....	1
CHAPTER 2 LITERATURE REVIEW	14
CHAPTER 3 METHODOLOGY	28
CHAPTER 4 RESULTS.....	35
CHAPTER 5 RECOMMENDATIONS	39
REFERENCES.....	54
APPENDIX A PRE AND POST SCIENCE TEST	59
APPENDIX B PRE AND POST SELF-EFFICACY SURVEY	61
APPENDIX C FRY READABILITY GRAPH	63
APPENDIX D HIGH SCHOOL GRADUATE READING SURVEY	64
APPENDIX E PARENTAL CONSENT FORM FOR MINORS (ENGLISH).....	66
APPENDIX F PARENTAL CONSENT FORM FOR MINORS (SPANISH)	68
APPENDIX G TEACHER PRE AND POST SURVEY.....	70
APPENDIX H TEACHER JOURNAL	72
APPENDIX I SPSS DATA	101
CURRICULUM VITAE.....	128

LIST OF TABLES

TABLE 1 FRY READABILITY DATA	29
TABLE 2 SCIENCE KNOWLEDGE TEST DATA	36
TABLE 3 SCIENCE KNOWLEDGE STANDARD DEVEIATION GRAPH	37
TABLE 4 SELF EFFICACY PART A SURVEY DATA	37
TABLE 5 SELF-EFFICACY PART A STANDARD DEVATION GRAPH	38
TABLE 6 SELF-EFFICACY PART B SURVEY DATA	38
TABLE 7 SELF EFFICACY PART B STATNDARD DEVATION GRAPH	39
TABLE 8 SCIENCE KNOWLEDGE ANOVA RESULTS	41
TABLE 9 SCIENCE KNOWLEDGE TEST MEAN GRAPH	41
TABLE 10 CONTROL GROUP DATA	42
TABLE 11 SELF-EFFICACY RELIABILITY SCORES	44
TABLE 12 TEACHERS SURVEY RESULTS	46

CHAPTER 1

INTRODUCTION

Scientific Literacy as defined in 1996 by the National Education Standards is “the knowledge and understanding of scientific concept and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity” (National Academy, 1996, p. 22). For some students Scientific Literacy comes as easily as their primary language, while for others the process of becoming literate in science is like learning a second language. Like with any new language, scientific literacy is learned by students being exposed to its words, gaining understanding of its principals as well as acquiring fluency. Providing students with an environment rich in science vocabulary and concepts assists students in building their content knowledge and comprehension. Robert E. Yager (1982) in his book, What Research Says To The Science Teacher Volume 4, acknowledges that science is the subject that has the best opportunity of gaining a students, “attention and awaken curiosity and wonder” (p. 19). It is the subject matter that “develops problem-solving skills while sharpening and promoting the application of reading and math skills” (p.19). It is the foundation of a sound science vocabulary, which allows educators to build from and expand their student’s prior knowledge for the educational years to follow.

Science educators often teach science using their prior knowledge and a textbook. Students must be involved in their learning in order to acquire understanding of the content and develop their individual links to the knowledge. Engaging student in hands-on activities, films, field trips and diverse modes of instruction will allow the teacher to address the diversity of learners in any classroom. Different teaching methods allow students to produce a mental picture of what they saw, touched, heard or experienced and then recall the content through association. Unfortunately the mental pictures held by experienced science educators regarding various topics may not be visualized by their students. The teacher's inability to engage their students own mental picture causes a breakdown in the student's connection to their prior knowledge, and comprehension necessary to becoming Scientifically Literate.

While inquiry based lessons may be incorporated into students studies, the processes to be followed are often outlined rigidly by the teacher or manual. In such cases students have minimal opportunities for creativity, or means to engage in constructivist thinking. The old philosophy of, "reading instruction in reading class only," is no longer acceptable (Dishner, 1981, p. 4). It is necessary for science educators to incorporate reading practices into each students daily learning experiences. It is this gained knowledge that students will use as prior knowledge in many if not all of his/her future decisions.

Being literate is imperative to being successful and productive in today's society. Learning to read, write, produce visual representations from mental pictures, as well as being able to communicate orally are all components of a literate individual. Being

scientifically literate allows students to open additional doors of opportunities for their future educational and professional lives. Providing the means for students to become scientifically literate assists them in making decisions that will impact their lives and their contributions to society.

The purpose of this thesis is to examine if there is a relationship between the introduction of young adult fiction, rich in science content, and student's scientific literacy. While research does support the usage of children's literature in improving student's science knowledge, therefore having an effect on their literacy, there is minimal documentation of literature usage for science instruction at the secondary level. It is necessary to conduct research utilizing young adult fiction literature at the secondary level in order to gain knowledge as to its relationship, if any on student's scientific literacy.

Definition of Terms

Literacy: In this study working definition of literacy will be used, "the ability to read with comprehension and purpose" (Czerneda, 1999, p. 1).

Scientific Literacy: In this study scientific literacy is defined as "the knowledge and understanding of scientific concept and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity" (National Academy, 1996, p. 22).

Fiction: In this study the definition of fiction is that which is found in Webster's dictionary, **1:** something invented by the imagination or feigned; *specifically:* an invented

story **2 a**: an assumption of a possibility as a fact irrespective of the question of its truth (Merriam-Webster Online, 2004).

Science Fiction: In this study the definition for Science Fiction will be that defined by Treiter, “fiction set in a world that differs from our everyday world in a way that importantly involves science and technology (Treitel, 1995, ¶ 2).

Young adult fiction: In this study the definition will be fiction “of its own kind, not a watered down form of adult-writing, but the link between the two is close” (Lucht, 1997, ¶ 12).

Quantitative inquiry: Focus is on testing a hypothesis by utilizing statistical methods of analysis (Worthen, pg. 521, 1997).

Constructivist: “Learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge. The learner selects and transforms information, constructs hypothesis, and makes decisions, relying on a cognitive structure to do so. Cognitive structure (i.e., schema, mental models) provides meaning and organization to experiences.” (Kearsley, 2003, ¶ 1)

Efficacy: “Power or capacity to produce a desired effect; effectiveness” (The American Heritage Dictionary of the English Language, 4th Ed., 2000).

Research Design and Population

The study will be conducted at a middle school campus from an urban school district. Cluster sampling will be utilized in a Compromise Experimental Group-Control Group Design in order to acquire a random subset from the school and district population (Kerlinger, 2000). School administration approved an 8th grade classroom for

participation in the study late last summer prior to student registration or students class assignments. The middle school adheres to an A-B schedule where teachers only see each student every other day for 90 minutes, students having 3 content classes each day. The eighth grade teacher who would assist in the study was approached upon approval by the administration, and she agreed to participate in the study. It was determined that her A student population would be identified as the experimental group and the B student population would be the control group.

Using a Compromise Experimental Group-Control Group Design allowed for a greater number of students to participate. Each student would complete pre and post science knowledge test (Appendix A) and self-efficacy survey (Appendix B) designed to investigate the student's perspective of his/her science inquiry levels prior to and upon reading completion of a science fiction book. In this study there will be fifty-five students participating, 23 will be members of the Experimental Group and 32 members in the Control group. The control group increases accountability for the effects of the experiment itself (Judge, 2001). Using the Experimental Group-Control Group Design (Chick, 2002) and students under the instruction of the same teacher as well as in the same school environment minimizes extraneous factors as to any difference between pre and post content tests, and self-efficacy survey (Fouad, 1997). Incorporating a self-efficacy survey (Fouad, 1997) we are able to determine if the student's confidence level in their ability to work in science has been affected by the study. Utilizing surveys permits larger student population to participate, allowing for a more credible analysis of the data collected.

Data Analysis

To determine if the null hypothesis:

Ho: Introducing science fiction literature into a 8th grades student's science Curriculum will have no impact on the student's scientific literacy level

will be rejected a “test of statistical significance” must be conducted on the data collected (Borg, 1979, p. 423). A Chi-Square Test with a 0.05 level of significance will be used to determine if an initial average scores difference between the experimental group and control mean exists prior to the implementation of the dependent variable being. In this study mathematically the null hypothesis would be represented as $H_0 : u_1 - u_2 = 0$ in which no difference between the population means are observed. The alternative hypothesis would be $H_1 : u_1 - u_2 \neq 0$ in which the data did demonstrate a mean difference in the two populations (Gravetter, 1992). In depth analysis of the studies data will be presented in Chapter 4.

Conducting a hypothesis test such as the ANOVA: simple repeated measures, will determine if a mean difference between the experimental and control group post tests exists upon completion of the reading. After conducting the analysis of the data it can be determined if the null hypothesis H_0 will be rejected, due to the fact that a significant difference between the experimental and control group was observed. In failing to reject the null hypothesis H_0 the data provided evidence that there was not a significant difference between the experimental and control group populations (Gravetter, 1992).

The self-efficacy survey (Fouad, 1997) results will also be analyzed utilizing ANOVA: simple repeated measures, to determine if a mean difference between the

experimental and control groups confidence level in their ability to work in science has changed in any way upon completion of the reading.

Young Adult Fiction book to be used in Study

The book selected for the study is Christopher Golden's young adult fiction *Body Bags* (Golden, 1999). *Body Bags* was selected for the study on the basis of its readability, introduction science related careers, strong science content, introduction of scientific terminology and methodologies, as well as its age appropriateness.

The books readability was determined by the Fry Readability test, which is discussed in detail in Ch. 3. Results from the Fry Readability test identified *Body Bags*' readability at the 6th grade reading level. While the class study population is 8th grade it is not inappropriate to utilize books, which are below grade levels by one or two years to gain better comprehension (Klare, 1963, Zakaluk, 1988). Students read below, at, and above their grade level it is important to remember that students' grade level is not always his/hers instructional level. Utilizing 6th grade reading material for this study is not unreasonable or inappropriate. As Frank Smith presents in his book *Reading*, "A child's preference is a far better yardstick than any readability formula, and grade levels have no reality in a child's mind" (Smith, 1994, pg. 211). The goal is to engage students in reading at whatever reading level so long as it is within their Zone of Proximal Development. The zone of proximal development "is the gap between a learner's current or actual level of development determined by independent problem-solving and the learner's emerging or potential level of development" (Wikipedia, 2004). The goal in this study was not to increase or improve a students reading level, but to engage the students

in reading science fiction to determine if there is any relationship between reading Young Adult Fiction and scientific literacy.

Throughout the book there arose the need to call upon individuals with specialties and expertise to determine the cause of the mysterious deaths. Introducing these careers requiring a science background could cause intrigue and options for students. The distinction between a coroner and a medical examiner was discussed in chapter 3. A coroner is an official not needing to or required to be an M.D. who would document a death. A medical examiner is an M.D., and pathologist, and is required to investigate “all sudden, suspicious, or violent deaths” (Golden, 1999, pg. 57). The college biology professor was consulted by the medical examiner regarding the larvae found inside a victim’s brain, but the professor refers the medical examiner to an entomologist whose specialty is studying insects. In lieu of them finding the source of the victim’s death it was necessary for the Centers for Disease Control to be notified and to work along with the medical examiner to assure that a quarantine situation would not arise.

Introducing the careers of coroner, medical examiner, biology professor, entomologist and members of the Centers of Disease Control gives students some perspectives as to the various fields, which they pursue in their professional goals (Golden, 1999).

The book’s main character Jenna at an early age of approximately 18 enters into a new episode of her life filled with mystery and intrigue. The book takes the reader along side Jenna through autopsies and investigation exposing the reader to an array of physiological and medical terms. The reader is introduced to such scientific terminology

as: sternum, electrolytes, hypodermic, larvae, toxicity, hemorrhaging and vitreous just to list a few. The reader is lead through the medical examiners discoveries in which Bovine spongiform encephalopathy is discussed also known us as mad cow disease, and his controversial diagnosis.

The introduction of a rain forest is presented to explain how unreasonable the theory of botfly native to the Costa Rica rain forest surviving to reproduce in the U.S. environment would be. Here the author takes the opportunity to introduce the scientific principal of a life cycle. The life cycle of a botfly is discussed in detail and how it was so unrealistic for this cycle to occur under the circumstances surrounding each of the victims.

The author introduces fiction along with mystery, but engulfed in accurate scientific facts. While mosquitoes are inhabitants of the U.S., the odds of one having contact with a botfly native to Costa Rica, and then enter victims ear canal undetected and depositing botfly larvae would be considered both mysterious and fictional. Not only is this scenario fictional, but also rich in building science content knowledge.

In introducing the usage of infectious insects as a weapon to apply leverage in politics may be seen today as fictitious. It is important to remember that science fiction of yesterday in many cases is now reality (Boutzev, 1984, Goswami, 1984, Kasev, 1984). The book carefully introduced the concept of a biological weapon when discussing if there was any foul play in the introduction of botfly larvae of the into the victims ears canal. Was the book prompting the reader to envision the possibility of infectious insects being used against individuals, factions, and countries in the future? Whatever the

writer's motive was the reality is that the future warfare weapons are yet to be seen (Golden, 1999).

Body Bag was finally chosen for its age appropriateness. The readability does fall into the range of a 7th grade student being at a 6th grade reading level. Students could easily identify with the character by her lifestyle such as; dancing, friends, likes and dislikes. The character also discusses her problems in relating to her parents desires for her life, which is not uncommon to the population participating in the study. It also prompts students to consider the diversity of their options for future careers.

What makes this book appropriate for this study is its accurate science conceptual foundation. The following are elements of scientific concepts evident in *Body Bags*:

- students inquiry regarding the science terminology
- students inquiry to research the physiological anatomy of humans
- students inquiry on Entomology
- students inquiry about botflies
- students inquiry about professions introduced
- students inquiry on biological weapons and warfare

Body Bags is the perfect example of the type of young adult fiction rich in science content that could be incorporated into the secondary schools science curriculum.

Prompting a students inquiry and higher order thinking, therefore increasing his/her scientifically literacy.

Conclusion

While scientific literacy is viewed as being an important attribute in being a successful individual in society (Hurd, 1998, National Education Standards, 1996) student are still arriving at higher educational institutions with minimal if any scientific literacy. Chapter 2 will present documented usage of science fiction and young adult literature as a tool for teaching science, the reasoning for its usage and its success presented by the individual educators. However, the documented programs and observations were conducted with populations at the levels of either elementary grades or higher education institutions. Additional information regarding these existing programs and observations will be presented in detail in Chapter 2.

Lack of documented research or statistical data as evidence to a student's perspective of his/her science inquiry levels prior to and upon reading completion of a science fiction book has not been found for a high or middle school science classroom. While documentation is found regarding secondary teachers utilizing science fiction literature as well as films, the student's success and increase in scientific literacy was never measured. Subject objectives targeted are identified, teacher's opinions and reactions to students success are documented, but again there is no statistical data to support or measure student success. In the literature review conducted a control group to measure student's perspective of his/her science inquiry levels prior to and upon reading completion of a science fiction book was never utilized. By not having a control group to determine if in fact the experimental variable was the determining factor to any change in student performance the results lack credibility.

In addition to the lack of experimental data, the inclusion of science fiction into the classroom has been informally introduced by individual teacher. The educator did not test a hypothesis to determine the impact of using science fiction in their classroom would have on student's knowledge (Reynolds, 1977). Increasing a student's science literacy has not been the focus observed in the casual introduction of science fiction, but rather as a tool for presenting material (Freedman, 1979, Powers, 1974, Schmidt, 1979, Marks, 1978).

Due to the lack of statistical data available to determine student's perspective of his/her science inquiry levels prior to and upon reading completion of a science fiction literature. It is crucial for this study to be conducted to determine if there is any change in student's scientific literacy levels when science fiction is used in the curriculum.

The study will be conducted at a middle school campus from an urban school district. Cluster sampling will be utilized in a Compromise Experimental Group-Control Group Design in order to acquire a random subset from the school and district population (Kerlinger, 2000). The focus and goal of this study is to investigate the student's perspective of his/her science inquiry levels prior to and upon reading completion of a science fiction book.

In conducting the research as described in Chapter 3 data will be collected and analyzed to determine if the null hypothesis would be rejected. Failing to reject the null hypothesis denotes that there was not a significant difference between the experimental and control group and the alternative hypothesis is accepted.

Null Hypothesis (H_0):

Introducing science fiction literature into a 8th grades student's science Curriculum will have no impact on the student's scientific literacy level

Hypothesis (H_1):

Introducing science fiction literature into a 8th grade student's science curriculum will increase the student's scientific literacy level

PREVIEW

CHAPTER 2

LITERATURE REVIEW

Science fiction literatures as well as cinematography are recommended as resources to be used in teaching everything from art to science. Literature and or science fiction literature has been incorporated into the curriculum by independent teachers in an attempt to motivate critical thinking and improve their student's comprehension in the content areas (Marks, 1978). East Texas State University documented an increase in the non-science majors enrolling in a physics course after the inclusion of Science Fiction in its curriculum (Zander, 1974). There are limited recent studies addressing the relationship of science fiction to literacy in schools.

The Nineteen Seventies

Since the 1970's science fiction literature has been a tool used by educators to engage students in higher order thinking (Martin, 1979, Reynolds, 1977, Zander, 1974). Gregory Benford, when not engaged in writing science fiction, works for the Atomic Energy Commission investigating controlled thermonuclear fusion stated the following:

“Science fiction is a way to get at the ambience of science-the thrill of discoveries. The kind of feeling for the way things work in distant fields shall we say. That is: what is the balance of all the facts one learns in science? What is their impact on human beings” (Lamb, 1975, p. 37)?

In other words science fiction allows students to gain a feeling about science that cannot always be relayed using only traditional teaching strategies (Lamb, 1975, p.37,

Benford, 1973). Gerald P. Calame, a member of the Physics Department in the U.S. Naval Academy taught a Physics course to seniors majoring in Physics which he based on scientific fiction. His decision to teach the course in this manner was based on the same ideology presented by Benford in 1973 (Lamb, 1975, Benford, 1973). Science fiction was accepted by the students with enthusiasm and it provided the scientific basis from which to develop a physics course. Each book used in the course was based on a specific scientific theme of which student's were to conduct and lead discussions regarding the background theme of the book which was correlated to science. These discussions would prompt inquiry, arguments and at times utter disbelief between the students, all of which expanded the student prior knowledge (Calame, 1973).

During this decade there was also an echoing by authors about utilizing science fiction to make students aware of the social implications surrounding the various disciplines of science, allowing student's to develop a well founded value system (Friedman, 1979, Marks, 1978, Powers, 1974, Schmidt, 1979). Joyce Powers in her article *Using Fiction to Teach Environmental Education* (1974) as well as Donna M. Schmidt in *Fiction and Environmental Education* (1979) both support each others beliefs that fiction, "strengthen and broaden the real-life experiences in a child" as well as "help teach values" (Powers, 1974, p.16, Schmidt, 1979, 20). Science fiction stories presenting specific ecological and environment themes are observed in Science Fiction literature. Schmidt, to support her stand on the importance of developing student's knowledge regarding the environment, quoted Voelker:

"An environmental education program will not be complete or effective until acquisition of conceptual knowledge-facts, concepts, principles-is perceived as only one of the many

inputs that lead to changes in behavior. To be effective, acquisition of conceptual knowledge must be fused with value and attitude formation and with the development of belief about the environment” (Schmidt, 1975, p. 20).

According to Schmidt this is accomplished since the theme in almost all science fiction stories dealing with environmental science deal with the “future consequences of past decisions” (Schmidt, 1979, p. 20). While non-fiction and content based text allow students to gain experience regarding science, reading science fiction literature is just one more “dynamic way” of stimulating young minds (Powers, 1974, p. 16).

While the seventies introduced how science fiction assisted educators in: presenting the concepts of thermodynamics in a college physics class (Friedman, 1979), exposing students to environmental issues on which to build their values (Powers, 1974, Schmidt, 1979), as well as, presenting controversial science content such as cloning (Marks, 1978) none of these authors discussed the measurable progress in their students. All the authors discussed was how science fiction could be and had been used. They did not present quantitative or qualitative data to support their position. While discussing a value system and gaining experiences in the field of science, both components of scientific literacy authors never mentioned or made reference to the term scientific literacy. Their work indicated elements of scientific literacy by identifying the components within science fiction literature that would provide science experiences for their students.

The Nineteen Eighties

The 1980’s introduced new strategies and methodologies which integrated science. Authors in this decade, as in the 70’s, emphasized the importance of motivating