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Curiosity and Gifted Identification: A Mixed Methods Study

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ABSTRACT

[ERIC Descriptors: Curiosity, Gifted and Talented, Gifted Identification, Adolescents, Assessment]

This dissertation was designed to explore the link between epistemic curiosity and giftedness, in order to provide an additional potentially non-biased assessment to contribute to gifted identification "body of evidence" files for underrepresented and underserved populations. Students of color and students of lower socio-economic status are less likely to be placed into gifted and talented enrichment programs (Donovan & Cross, 2002). If a significant relationship is found between high curiosity and students who benefit from gifted education, psychometric instruments used for measuring curiosity could be invaluable in placing students in appropriate educational environments.

The study used a mixed methods design to measure epistemic curiosity in gifted and non-gifted populations for comparison, as well as conducted interviews to better understand perspectives of curiosity in both populations. If a strong difference between curiosity by giftedness was identified, and no mitigating factors found that might adversely change the reliability of the data, then the author can propose the recommendation that curiosity surveys be included in gifted identification "body of evidence" (BOE) portfolios nationwide.

ACKNOWLEDGEMENTS

This dissertation is dedicated to my wife Pharlain Ross, and to my children Rowan Antigone Ross and Somerled Edmund Alexander Ross, who were both born during its creation.

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Chapter 1: Introduction

Statement of the Problem

Gifted and Talented (GT) is a designation assigned to

> Students, children, or youth who give evidence of high achievement capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who need services and activities not ordinarily provided by the school in order to fully develop those capabilities" (No Child Left Behind Act, 2001, Section 9101, 22).

Additional academic enrichment is offered only to students who qualify as GT, based on the varying criteria of individual states and school districts, usually as a result of intelligence testing, academic achievement, and/or recommendation from teachers and parents (Colangelo & Davis, 2003; Clark, 2008).

For students with asynchronous development, the opportunity for deeper, richer curriculum can be essential (Colangelo & Davis, 2003; Clark, 2008). Specialized curriculum for gifted students could involve "pull-out" programs or differentiated classwork within a mainstream class. Regardless of the form it takes, adjusted curriculum for gifted learners is an unfunded federal directive (Jacob Javits Gifted and Talented Students Education Act, 1988; Jacob Javits Act re-authorization, 1994).

Students of color are underrepresented and underserved in gifted education in the United States (Abell & Lennox, 1999; Bernal, 1981; Courville & DeRouen, 2009; Erwin

& Worrell, 2012; Ford, 1995, 1998, 2010; Naglieri & Ford, 2003). Current identification methods appear to be overlooking a large portion of American students due to unconscious bias in "gatekeepers" (teachers and other education specialists who make the recommendations for gifted identification) and established bias in cognitive assessments used as the primary tools for recommendation to these programs (Ford, 1998, 2010; Gagné, 1994; Jacobs, 1971; McBee, 2006; Peterson & Margolin, 1997; Siegle, 2001). If giftedness exists in the same percentage of all racial and ethnic demographics, then there are over 500,000 gifted students nationwide who have not been identified and are not deemed eligible for enrichment programs appropriate to their cognitive abilities (Ford, 2010).

The Researcher

The inspiration for this research project came from my work as a high school social studies teacher for students with an array of academic strengths and weaknesses over the better part of a decade. A number of my students had been placed in gifted and talented enrichment programs when they were younger, but had struggled with school as adolescents (often due to learning disabilities, mental health problems, or addiction). These students tended to be more motivated to do additional independent deeper explorations of social studies topics than most of the mainstream students. I began to wonder if curiosity was, in fact, a common thread that ran through all my gifted students.

While my work began with a focus on twice-exceptional students –that is, students both identified as gifted and diagnosed with some sort of disability that complicated their educational process— reading Donna Ford's seminal book

Multicultural Gifted Education (Ford & Harris, 1999) and meeting Doctor Ford in person opened my eyes to the deep inequities in the gifted education system in regards to students of color. The two strands of interest gradually combined: high curiosity in white middle-class gifted students surely applied to black and Hispanic gifted students as well. Furthermore, if high trait-based curiosity was present in gifted students, could it be used as a criterion for gifted identification?

Educational researchers like Ford and Harris have clearly established a prolonged pattern of discrimination (whether intentional or not) against gifted students of color and lay the blame firmly at the feet of biased assessments (Scarr & Weinberg, 1976; Ford & Harris, 1990, 1991, 1999, 2001; Fagan & Holland, 2002). If the assessments are biased, there is obviously a need for more comprehensive and inclusive methods for identification that will recognize gifted students who might otherwise escape attention. Assembling a *body of evidence* about a student that features multiple identification methodologies is necessary to assure that gifted students are not overlooked due to unexamined bias. Furthermore, this body of evidence must include recognition of known characteristics of gifted children as part of its assessment.

Informal, generalized descriptions of gifted and talented students commonly reference their unusual curiosity (Durr, 1960; Miller, 1964; Colangelo & Davis, 2003; Johnson, 2011; Clark, 2008) and the National Association of Gifted Children lists curiosity as one of the "traits of giftedness" (NAGC, 2015). If this assertion is more than a baseless stereotype, identifying high levels of curiosity may provide a bias-free tool for gifted identification. Research referencing the psychometric tools used to measure

curiosity could be used to confirm that gifted children are, in fact, highly curious by their nature, to definitively remove curiosity of gifted children as a defining characteristic, or to confirm that there is such a high correlation between the two constructs that additional information regarding curiosity is redundant.

Conceptual Framework

This research project is framed by two major theoretical lenses. The first of these is a Critical Theory perspective: while the research itself was not conducted on any particular subaltern group, the purpose of the work was always focused on the inequity endemic to gifted education, and an attempt to subvert this power structure. This research is intended to be transformative, and to address elements of institutional classism and racism. As Paulo Freire (1985) said, "Washing one's hands of the conflict between the powerful and the powerless means to side with the powerful, not to be neutral."

Beyond the philosophical underpinnings and justification for the work lies a second theoretical framework necessary for conducting the research: that of Pragmatism. "A Pragmatic Theoretical lens features multiple avenues of data collection, mixing qualitative and quantitative methods, will focus on practical implications of research" (Creswell & Creswell, 2013). A Pragmatic approach to research favors mixed methodology and a focus on "whatever works" rather than a dogmatic adherence to any particular philosophy; it may be inelegant, but it does what is needed (Creswell, 2010; Creswell & Creswell, 2013). The work was designed with this combination of these two lenses always in mind: one to guide the purpose of the research and another to aid in conducting it.

Purpose Statement

The purpose of this study was to explore the use of a measure of epistemic curiosity (Berlyne, 1954) as a potential identification tool for increasing equity in gifted education. In this convergent parallel design, adolescents identified as gifted and talented were given established quantitative instruments for curiosity and interviewed to generate qualitative data regarding curiosity. The goal was to test for a difference between mean scores on a test of the trait of curiosity, as measured by current non-cognitive psychometric instruments, and identification as gifted and talented in 9^{th}-12^{th} grade gifted student populations versus not identified. Interviews were then conducted as both an explanatory element and potential tool for triangulation. The strands were mixed in the analysis phase with the explicit transformative purpose of determining whether psychometric screens for curiosity hold any potential as a tool for identifying gifted students who may have been missed by traditional methods of GT (gifted and talented) identification. Interviews were used for explanatory purposes or to attempt to identify bias with the quantitative instrument. The biggest obstacle to conducting this research involved finding appropriate subjects or participants to use in the study. The major interest was in possibility that the findings would or would not justify further research into curiosity as a gifted identification tool.

Research Questions

This research project aims to answer a number of questions, which in turn lead to even more questions.

- Is epistemic curiosity related to giftedness? Is there truth to the oft-repeated (Colangelo, 2003; Clark, 2008) assertion that curiosity is one of the traits that distinguishes gifted from non-gifted students? If so, there are potential avenues for using that information to identify gifted children in traditionally underrepresented populations (specifically black, Hispanic, and low socio-economic status).
- How does epistemic curiosity manifest in gifted populations? Do students' views on curiosity shed any light on the construct of curiosity itself? Does the *expression* of curiosity differ between gifted and non-gifted students? How is the educational experience of a curious student distinctly different depending on the type of program (gifted or mainstream) they are in? Do gifted children have a fundamentally different view of the acquisition of new information than non-gifted children? Are they more likely to possess anxiety-driven or pleasure-driven curiosity impulses (D-Type and I-Type curiosity, respectively)?
- To what extent do the quantitative and qualitative data collected converge? Could quantitative research collection be a predictive measurement of curiosity or is the greater depth provided by qualitative data necessary to explain results, or does the qualitative data reveal a flaw in the quantitative data collection technique or vice versa? What does high curiosity really *look like* in the academic life of a student? Is it culturally or economically specific?

The data gathered in this investigation should lead to more questions and introduce new avenues of research.

Introduction to the Literature

The History of Giftedness

The very conception of giftedness as a characteristic (or collection of characteristics) emerged from the work of intelligence theorists in the late 19th and early 20th century. Today, definitions of giftedness vary dramatically depending on the source, largely due to divergent theories of intelligence and mental acuity. The history of giftedness and gifted education will trace the origin of the framework that educators, policy-makers, parents, and researchers use when describing an individual who is gifted and talented. The intent is to demonstrate that the history of gifted education comes from a long and ugly history of racism and eugenics, and that this history has contributed to a system of institutional neglect of certain groups of children.

Issues of Diversity and Inclusion Within Gifted Education

The current system of identification of gifted children strongly favors white children of moderate-to-affluent socio-economic status. The literature review will explain the research into this trend, as well as offer possible causes for the inequity. This section of Chapter 2 will focus on cultural bias in the quantitative measures used to screen for giftedness, as well as the bias often present in a system that relies on referral from teachers who have a culturally specific conception of what giftedness entails. The

literature illuminates the institutional racism and classism that artificially segregates the programs that benefit gifted children.

Giftedness and Curiosity

Curiosity is often listed as a defining trait for gifted children in the gifted literature (Colangelo, 2003; Clark, 2008). However, there have been limited attempts to find an empirical link between these characteristics. Henderson, Gold, and McCord (1982) conducted research on the degree of daydreaming in gifted and mainstream populations, reaching the conclusion that gifted students were more likely to daydream than their mainstream peers, whether this is a reflection of trait-based curiosity or not. In order to answer my research questions, however, greater attention must be paid to the literature surrounding curiosity research as a whole.

Frameworks of Curiosity Research

The investigations of curiosity stemming from the work of Daniel Berlyne (1954; 1960; 1962; 1966; 1978) and the researchers who built on his framework provide the lens through which it is possible to examine curiosity in gifted populations. Specifically, it is important to make the distinction between *perceptual* and *epistemic* curiosity. Perceptual curiosity is a state generated by exposure to novel stimuli, and experienced by all humans, as well as animal subjects (Berlyne, 1954), but it is epistemic curiosity that my research seeks to measure. Epistemic curiosity is a trait within humans that measures the impetus to seek out new information (Berlyne, 1954, 1960).

This research project embraces Berlyne's theoretical framework, as well as that of Dr. Jordan Litman (2005; 2008; 2010), who added a further distinction to Berlyne's

model of epistemic curiosity by proposing that curiosity was divided between a neurochemical reward for uncovering new information and a similar neurochemical "punishment" of increased anxiety levels for failing to resolve questions. This model, known as the *wanting-liking model,* allows for an even more explicit examination of styles of epistemic curiosity.

Introduction to Research Methodology

This research project aimed to compare mean scores on a curiosity measure between gifted high school students and non-gifted students to determine if a gifted population of adolescents has a higher mean for epistemic (trait-based) curiosity than the non-gifted population. The quantitative investigation further differentiated between I-Type (interest-based) curiosity and D-Type (deprivation-based) curiosity, which generated illuminating data about not only the degree of curiosity, but also the nature of that curiosity.

To determine both the degree and the expression of epistemic curiosity, I utilized a mixed methods approach to research. Initial quantitative research was conducted using two separate established instruments, the Need for Cognition (NFC) scale developed by Cacioppo and Petty in 1982, which is designed to measure desire for cognitive behavior – i.e. the desire to engage in thinking— which is strongly correlated with the model of epistemic curiosity, and Dr. Litman's Interest/Deprivation Scale (2008) designed to measure I-Type and D-Type aspects of epistemic curiosity.

This quantitative strand of research was supplemented with a number of in-depth interviews with participants along the spectrum of responses on the quantitative

instrument. A sub-sample of the quantitative strand was selected based on their scores (extremely high and extremely low). Through this further qualitative investigation, responses were clarified, explained and elaborated on, revealing greater insight to the nature of curiosity in gifted populations that the application of a quantitative instrument by itself could not.

Specifically, the question of how epistemic curiosity manifests in gifted populations was addressed in a way that the quantitative research simply cannot. The line of questioning in the interviews shed light on the specific manifestations of the two fundamental drives behind curiosity (pleasure-driven interest-based I-Type curiosity and anxiety-driven deprivation-based D-Type curiosity). While the Interest/Deprivation Scale revealed distinct differences between the two types, interviewing was necessary to find out how those expressions impact the academic and personal behaviors of gifted students.

The interview participants were selected from the larger sample of gifted students and smaller sample of non-gifted students based on their scores on the quantitative measures. While initially it was suggested that a third party would select the interview recipients so that the interviewer would not be biased, this proved impossible in application. The interviewer contacted the respondents who matched the highest and lowest scores on the I, D and NFC measures.

If the quantitative data and qualitative data did not converge, a comparison of the interview responses would provide some illumination as to the cause for the discrepancy. Should there have been a significant disparity between quantitative and qualitative data, a closer examination of the interview responses would shed some light on the cause. At the

very least, this would have provided insight on how to improve the quantitative measures for future research.

Potential Benefits

A thorough, in-depth study featuring rich quantitative and qualitative data would provide the basis to make recommendations about changes by policy-makers and gifted education specialists to gifted identification systems nationwide. If evidence exists that gifted children, even the predominantly white students who make up the majority of gifted programs nation-wide, are definitively more likely to have high levels of curiosity as measured by psychometric tools, then curiosity assessment can be incorporated into the body of evidence necessary for equitable gifted identification. Curiosity identification can become one tool of many to recognize gifted potential in students who are overlooked by traditional assessment methods.

Specifically, if curiosity assessments are used as part of a gifted identification body of evidence, then a number of children may be identified who would otherwise not be recognized for their giftedness due to institutional bias, delayed introduction to academics due to socio-economic status, non-middle class expressions of advanced cognitive development, learning disabilities which mask advanced abilities, or lack of parental bureaucratic fluency with the academic system.

On the other hand, it was possible that this research would not reveal any significant differences in curiosity between gifted and non-gifted students. In this case, the labeling of curiosity as a distinguishing trait in gifted populations can be corrected in future publications about gifted children and their characteristics.

Chapter 2: Literature Review

Research Questions

Is high epistemic curiosity positively related to giftedness?

How does epistemic curiosity manifest in gifted populations?

To what extent do the quantitative and qualitative data converge? How and why?

History of Intelligence

Gifted Education has its basis in the work of theorists from the late 19th and early 20th century, who introduced the concept of intelligence as a measurable construct. Sir Francis Galton –who included the study of sociology, psychology, anthropology, statistics, geography, and meteorology among his areas of study— was the first to speculate in academic publications (Galton, 1869) that intelligence was a hereditary trait, inherited as part of his cousin Charles Darwin's recently announced theory of natural selection (Forrest, 1974). Galton coined the term "eminent" to describe individuals who had abnormally high intellectual abilities. He is, unfortunately, also credited with starting the eugenics movement (and coining that term as well) (Galton, 1883). He recommended grouping people into four categories and either limiting reproduction between the lower groups or incentivizing reproduction between the higher ones (Galton, 1869).

In the early 20th century, psychologist and statistician Charles Spearman proposed a theory of a single trait (*g*) that represented mental energy. He proposed that multiple assessments of cognitive ability were merely measuring reflections of *g*. (Spearman, 1904). Like Sir Francis Galton, Spearman asserted that *g* was hereditary, but also that it was innate and not affected by environmental factors. (Neisser et al, 1996) Shortly after the introduction of Spearman's "*g* theory," French researchers Alfred Binet and Theodore Simon developed a series of tests to measure intelligence, specifically to identify children with low mental functioning (Zangwill, 1987). This test measured "mental age" in subjects, and was groundbreaking due to its single numerical outcome. Subsequent intelligence tests have followed the Binet-Simon test in trying to reduce intelligence (whether *g* or some other conception) to a quantitative variable. Unlike Spearman, Alfred Binet believed intelligence was malleable and could be influenced by environmental factors (Siegler, 1992).

Henry Goddard is credited with bringing the Binet-Simon tests to America in the early 20th century (Zenderland,1998). Goddard had studied with Simon and Binet, and expanded the use of cognitive assessment to adults. While he is the psychologist who first pushed for a mandate for special education for the disabled, he was also a eugenicist who coined the term "moron" and believed that sub-optimally intelligent individuals should be segregated in colonies to keep them from polluting the gene pool. He established intelligence testing for incoming immigrants at Ellis Island, and his biased findings were consistent with his beliefs in racial superiority: he determined that 83% of Jews, 80% of Hungarians, 79% of Italians, and 80% of Russians in his study population were "feeble-

minded" and inferior to the existing American citizenry (Snyderman & Herrnstein, 1983). While his findings have been widely disputed, his work may have led to more restrictive immigration laws (such as the Immigration Act of 1924) and justified popular xenophobia and racism.

Lewis Terman has been called "the father of the gifted education movement" (Colangelo, 2003, pp 6); he conducted the first longitudinal study of "precocious children" (nicknamed "Termites"), establishing for the first time that gifted children had different academic needs than children their age. Gifted education since Terman's study has been a series of initiatives to help children with advanced development in one area or another (or across many traits) reach their full potential (Vialle, 1994). But even this outwardly progressive movement was still couched in racially dismissive terms (Leslie, 2000).

Terman defined giftedness in terms of intelligence, and utilized the Stanford-Binet test that he himself had published as the instrument for measurement (Vialle, 1994). His unidimensional definition, which lacks recognition of creative, artistic or social gifts, defined giftedness as the 99th percentile on this standardized IQ test (Terman, 1924).

Like some of his predecessors, Lewis Terman held some strong beliefs in eugenics. His private writings indicate that his research into highly intelligent children was informed by elitism (Leslie, 2000). He was a proponent of forced sterilization of those of sub-optimal intelligence, and was not shy about making his views on race known:

> High-grade or border-line deficiency... is very, very common among Spanish-Indian and Mexican families of the Southwest and also among negroes. Their dullness seems to be racial, or at least inherent in the family stocks from which they come... Children of this group should be segregated into separate classes... They cannot master abstractions but they can often be made into efficient workers... from a eugenic point of view they constitute a grave problem because of their unusually prolific breeding (Terman, 1916).

The work of Louis Leon Thurstone in the 1920s through 1940s proposed that intelligence was composed of seven Primary Mental Abilities which contributed to an overall construct to varying degrees. His work moved cognitive testing away from the conception of mental age that had been established by Alfred Binet and his disciples instead towards an analysis of standardized mean and standard deviations from that mean (Horst, 1955).

In his keynote address to the annual American Psychological Association in 1950, J.P Guilford rejected Spearman's *g* theory and introduced yet another multi-faceted construction of intelligence. Guilford's theory proposes that there are three dimensions of intelligence: operations (cognition, memory recording, memory retention, divergent production, convergent production, evaluation), content (figural, symbolic, semantic, behavioral), and products (units, classes, relations, systems, transformations, implications) (Guilford, 1956).

History of Gifted Education

In 1954 –the same year that schools were desegregated due to the Supreme Court ruling on Brown vs. The Board of Education- the National Association for Gifted Children was founded. The NAGC remains the largest advocacy organization for giftedness in the country, releasing a quarterly peer-reviewed academic journal, position

papers on aspects of gifted education, and a yearly convention that highlights research in the field (NAGC.org).

When the Soviet Union launched a satellite into orbit in 1957, the United States government re-evaluated the quality of science education in the country and introduced new programs to try to remain competitive in the space race. The National Defense Education Act was passed only a year later, allocating over one billion dollars to STEM (Science, Technology, Engineering, Math) fields in public education. Title V of the NDEA included provisions for training educators to identify gifted students. As part of this research, 460,000 students in 1,000 high schools were given standardized IQ tests; a full scale score of 130 was the chosen cut-off to determine whether a student was considered gifted, although there was not yet a mandate (or funding) for specialized gifted education in all public schools. (National Defense Education Act, 1958)

Throughout the 1960s, standardized IQ testing in public schools increased. J.P. Guilford's theory of intelligence influenced another wave of researchers such as J. W. Getzel, Phillip Jackson, and E. Paul Torrance, who introduced the aspect of creativity as an essential dimension in a multi-faceted model of intelligence (Getzel & Jackson, 1958; Torrance, 1961). The federal government formalized an acknowledgement of gifted children (using the newer conceptions of intelligence) with the Education of the Handicapped Act of 1970:

> The term "gifted and talented children" means, in accordance with objective criteria prescribed by the Commissioner, children who have outstanding intellectual ability or creative talent the development of which requires special activities or services not ordinarily provided by local educational agencies. (Education of the Handicapped Act, 1970)

Definitions of Giftedness

The Marland Report, released in 1972, was the first formal federal recognition of the importance of gifted education (Colangelo & Davis, 2003). The report, which revealed a startling lack of opportunities for gifted children nationwide, also included the following definition of giftedness:

> Gifted and talented children are those identified by professionally qualified persons, who by virtue of outstanding abilities are capable of high performance. These are children who require differentiated educational programs and/or services beyond those normally provided by the regular school program in order to realize their contribution to self and society.
>
> Children capable of high performance include those with demonstrated achievement and/or potential ability in any of the following areas, singly or in combination:
>
> 1. General intellectual ability,
> 2. Specific academic aptitude,
> 3. Creative or productive thinking,
> 4. Leadership ability,
> 5. Visual and performing arts
> 6. Psychomotor ability (Marland Report, 1972)

The Marland Report led to The Gifted and Talented Children's Education Act of 1978, (Eckes, n.d) amending the Elementary and Secondary Education Act of 1965 to authorize grant programs for gifted and talented children at the preschool, elementary, and secondary levels (Elementary and Secondary Education At, 1965). This bill presented another definition of gifted education:

> …the term 'gifted and talented children' means children and, whenever applicable, youth, who are identified at the preschool, elementary, or secondary level as possessing demonstrated or potential abilities that give evidence of high performance capability in areas such as intellectual, creative, specific academic, or leadership ability, or in the performing and visual arts, and who by reason thereof, require services or activities not ordinarily provided by the school. (Gifted and Talented Children's Education Act, 1978)

Jacob K. Javits Gifted and Talented Students Education Act of 1988 (named for New York Senator Jacob Javits, who was a strong advocate for gifted education funding at the federal level) introduced yet another definition of giftedness. This law was passed to coordinate various gifted and talented programs, and to encourage gifted education in public schools, although there was never any federal funding allocated for this agenda, nor were gifted students granted any legal rights (as in the case of children in special education). The Javits Act was reauthorized in 1994 and again as part of the No Child Left Behind Act of 2001 (Title V, Part D, Subpart 6) (Eckes, n.d).

> The term 'gifted and talented' when used in respect to students, children, or youth means students, children, or youth who give evidence of high performance capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who require services or activities not ordinarily provided by the school in order to fully develop such capabilities. (Jacob Javits Gifted and Talented Students Education Act, 1988; Jacob Javits Act re-authorization, 1994)

The Javits program was included in the passage of the Every Student Succeeds Act (ESSA) in 2015, which was itself a reauthorization of the 1965 Elementary and Secondary Education Act and the successor to No Child Left Behind. Javits currently receives $12 million dollars annually, with the purpose of coordinating gifted education nationwide and conducting research on gifted education and in particular students of color, in poverty, linguistically disadvantaged and disabled, although it does not fund specific local gifted education programs. Like other federal grant programs, the Javits Act must be funded every year by Congress (National Association of Gifted Children, 2018).

In 1993, the United States Department of Education published a report entitled National Excellence: A Case for Developing America's Talent. This report likewise included yet another definition of giftedness:

> Children and youth with outstanding talent perform or show the potential for performing at remarkably high levels of accomplishment when compared with others of their age, experience, or environment. These children and youth exhibit high performance capability in intellectual, creative, and/or artistic areas, possess an unusual leadership capacity, or excel in specific academic fields. They require services or activities not ordinarily provided by the schools. Outstanding talents are present in children and youth from all cultural groups, across all economic strata, and in all areas of human endeavor. (U.S Department of Education, 1993)

Finally, separate from the United States Department of Education, private advocacy groups have developed their own definitions. The following is the definition put forward in position papers by the National Association of Gifted Children.

> Gifted individuals are those who demonstrate outstanding levels of aptitude (defined as an exceptional ability to reason and learn) or competence (documented performance or achievement in top 10% or rarer) in one or more domains. Domains include any structured area of activity with its own symbol system (e.g., mathematics, music, language) and/or set of sensorimotor skills (e.g., painting, dance, sports). (National Association of Gifted Children, 2010)

Annemarie Roeper, the founder of the Roeper School and a late luminary of gifted education, described giftedness as "a greater awareness, a greater sensitivity, and a greater ability to understand and transform perceptions into intellectual and emotional experiences. (Roeper, 1982, p. 21)"

The Columbus Group, an independent group of experts in gifted and talented education and parents of gifted children affiliated with the Institute for the Study of Advanced Development (ISAD), defined giftedness in 1991 as,

> Asynchronous development in which advanced cognitive abilities and heightened intensity combine to create inner experiences and awareness that are qualitatively

> different from the norm. This asynchrony increases with higher intellectual capacity. The uniqueness of the gifted renders them particularly vulnerable and requires modifications in parenting, teaching and counseling in order for them to develop optimally. (National Association of Gifted Children, 2018a)

Individual States have varying definitions as well. For instance, Pennsylvania uses language from the 1970 Education of the Handicapped Act, Delaware uses the definition from the 1972 Marland Report verbatim, Nebraska uses language from the 1988 Jacob Javits Act, Illinois uses language from the 1993 National Excellence report, while Colorado's definition is identical to that of the National Association of Gifted Children and Alaska simply defines it as "…exhibiting outstanding intellect, ability, or creative talent." (National Association of Gifted Children, 2013)

Even within individual states, definitions can vary from district to district. For instance, while the Colorado Department of Education has adopted the NAGC definition, districts have added their own language to their working definitions. Boulder Valley School District changes the age range from "between the ages of five and twenty-one" to "from kindergarten through twelfth grade" and explains the multiple criteria and documentation of gifted students (Boulder Valley School District, 2015). Denver Public Schools replaces the categories of giftedness from the NAGC definition with "These students perform, or show the potential of performing, at remarkably high levels in intellectual, specific academic or creative areas when compared with others of their age and experience" (Denver Public Schools, 2015). This lack of consensus on how even to describe giftedness means that in many schools the identification of gifted students remains largely unchanged from Lewis Terman's work.

Gifted and Talented Programs

Current agreement about gifted programs seems to focus on creating a deeper and broader curriculum than a mainstream classroom, in order to fight classroom boredom and provide additional challenge without punishing a gifted student with additional work. (Colangelo & Davis, 2003) Due to the realities of funding and increasing classroom size, most schools lack the resources to provide deeper and richer curricula to more than a small segment of students, and sometimes not at all (the Jacob Javits Act provides limited federal funding for gifted initiatives, but not funding for local programs).

> Gifted education, whatever its form, is nearly always a rationed good that cannot be supplied to all who crave it – and from which some cravers may not even derive great benefit, indeed might even retard the progress of those who stand to gain the most. At the same time, fairness demands that any public education system bend over backwards not to deny this opportunity to youngsters who might benefit from it even if their parents and teachers fail to point them towards it. (Finn & Wright, 2015, pp 46-47)

Educational institutions, therefore, apply a variety of criteria (IQ testing, academic success, state standardized tests, teacher or parent recommendation), to determine who is eligible for this gifted education programming, leading some to speculate that the best way to determine the effectiveness of gifted identification is whether a student thrives in the enriched academic program or not (Renzulli & Delcourt, 1986).

The gifted and talented identification process varies a great deal from district to district (or not at all). Depending on resources and policy, schools may utilize some form of referral process, most commonly from teachers who work with the child. Many school districts also have automatic identification based on high scores on standardized

academic tests as well (Coleman et al, 1994). Perhaps not surprisingly, the small segment of the school population eligible for deeper and richer curriculum based on teacher referral and standardized tests has traditionally reflected high academically achieving students. (Coleman et al, 1994; Gagne, 1994; Moon & Brighton, 2002; Colangelo, 2003) Coincidentally, these measures result in glaring underrepresentation of non-white, low socio-economic status students (Hunsaker, 1994; Passow, 1996; Ford 1995, 1998; Courville & DeRouen, 2009; Erwin & Worrell, 2012), leading to allegations of elitism and racism within gifted education as a whole (Sapon-Shevin, 1993).

Alamprese and Erlanger (1988) stated that African American males nationally were half as likely to be labeled as gifted and talented, but three times more likely to be placed in special education classes for the developmentally delayed. In some areas, this underrepresentation is as high as 70% (Harris & Ford, 1999). This trend appears to be getting even less equitable over time. According to the Office of Civil Rights (1992), African American underrepresentation in gifted programs was 34% in 1978, 43% in 1992, 48% in 2010. Examining data from the Children's Defense Fund and National Coalition of Advocates for Students, Harris and Ford (2004) found that,

> Black students represent 16% of the public school population but 27% of all students classified as trainable mentally retarded or seriously emotionally disturbed, but also 8% of gifted programs, 30% of all students expelled, and 31% of those who have received corporal punishment." With an even statistical distribution, this data points to more than 253,000 Black students nationwide who should have been identified. Combined with Hispanic underrepresentation, GT programs should have 500,000 more students of color then they currently do (Ford, 2010).

Low socio-economic status also plays a role in under-identification: Abell and Lennex (1999) determined that SES was a major factor in the identification of gifted

students due to a gap in standardized test scores between affluent students and economically disadvantaged ones. They go on to say that students of lower socio-economic status are less likely to have parents that are familiar with how to best take advantage of the educational system and are less equipped to help their children acquire academic skills outside of the classroom. The social capital of affluent students, on the other hand, often enables them to take advantage of enrichment opportunities that allow them to excel at norm-referenced tests (Abell & Lennox, 1999). McBee (2006) states that students eligible for free or reduced lunch are nominated for gifted programs at a third of the rate of their higher SES peers and identified through parent referral or automatic referral via standardized testing at one fourth the rate. "Thus, if students are both cultural minorities and economically disadvantaged, which may often be the case, they are subject to discrimination in the identification process on multiple fronts" (Courville & DeRouen 2009, p. 8).

Underrepresentation

Reasons for underrepresentation are frequently broken down into several distinct areas. The conflicting definitions of giftedness may be one cause (Ford, 2010). The current federal definition states that, "Outstanding talents are present in children and youth from all cultural groups, across all economic strata, and in all areas of human endeavor." The federal definitions since the 1993 revision includes inclusionary language, while the earlier 1978 version does not. However, some states and districts are still using the 1972 definition from the original Marland Report or the 1978 revision, which both lack the language about "potentiality" and may rely almost exclusively on test

scores (National Association of Gifted Children, 2013). Districts using IQ test scores as their primary metric for GT identification can set the cut-off almost arbitrarily: while Lewis Terman set the threshold at 130, there is no federal definition that includes a set IQ score. While luminaries in the field of gifted education (Sternberg, Gardner, Renzulli, etc.) have argued for broader definitions (which may include other expressions of a student's giftedness), intelligence or academic achievement tests remain the dominant method for GT identification (National Association of Gifted Children, 2017).

This over-reliance on tests poses a significant hurdle to equitable representation in gifted education. White students tend to score higher on IQ tests than Black students, up to 15% higher by some accounts (Fagan & Holland, 2002). Modern intelligence tests are norm-referenced, but they may not be normed on a diverse population (Ford, 2010). While there are those who have argued that the gap in test scores between White and Black students represents an inherent deficit in intelligence among Black students (for instance, Herrnstein & Murray's *The Bell Curve: Intelligence and Class Structure in American Life,* 1994, which sparked an uproar for suggesting this very thing), there is ample evidence to believe that this discrepancy is environmental in nature: Scarr and Wienberg (1976) conducted a study of Black children raised by White parents and found that they scored at least 20 points higher than similar children raised in Black communities. Scarr and Weinberg concluded that this proved that there was no genetic deficit in intelligence among Black children and that the tests in question had a distinct bias that could be overcome by growing up in the culture favored by the test.

Another possible factor for low test scores among students of color is *stereotype threat:* research dating back to 1995 has shown that when test-takers are reminded of a negative stereotype of a group they belong to, they are more likely to perform in line with that stereotype when confronted with an assessment that reflects that stereotype (Steele & Aronson, 1995). If Black and Hispanic students are convinced that they stereotypically *should* score lower on normed cognitive tests, they are likely to do so when aware of that stereotype. Given the history of over-representation of affluent white children in gifted programs, stereotype threat may be responsible for low performance on the very assessments that would allow students of color to join those same programs (Howard & Hammond, 1985; Ford et al., 1991).

The differences between IQ test scores of Black and White students are so prevalent and predictable that education researchers like Lohman (2005) have suggested simply adjusting admittance requirements by the statistical discrepancy. Lohman suggests that African-American students have been shown to score an average of 15 points below White students due to bias within the test, that perhaps the required scores for GT programs be set 15 points lower for Black students. However, Lohman's proposal includes no prescription for students of mixed race or for adjustments to account for socio-economic status.

Whether this is cultural test bias or some other failure of measurement, the end result is the same: students of color are at a disadvantage when potentially biased tests are used as the only citeria for admittance to gifted and talented enrichment programs (Ford & Harris, 1990; Ford, 1998; Ford et al. 2002; Erwin & Worrell, 2012). This creates a

false meritocracy: a system that seems to reward high achievement, but fails to take into consideration factors which may bias the objective standards against certain groups (Lampert, 2013). With potentially biased testing and inconsistent definitions, it is no wonder there is such an issue with underrepresentation. This sort of restricted access to deeper and richer curriculum represents systematic discrimination and institutional oppression, whether intentional or not (Howard & Hammond, 1988; Abell & Lennox, 1999; Boothe & Stanley, 2004).

The second and third reasons for underrepresentation in gifted programs are due to failures in the teacher referral process and the underlying deficit thinking that causes that failure (Peters & Gentry, 2012). One of the earliest papers regarding the shortcomings of teacher referral in gifted education is the research conducted by Pegnato and Birch in 1959 comparing teacher perception to Stanford-Binet IQ testing. That study showed that teachers only nominated 45% of students who had IQs higher than 136. Furthermore, 27% of the students they did nominate did not have the 136 IQ necessary for GT identification. Jacobs (1971) painted an even more grim picture: teachers were only able to identify 10% of their students who had scored high on IQ tests. Gagne argued in 1994 that there was flawed methodology with the Pegnato and Birch study, and that the identification was exaggerated, but when teacher referral is necessary for a student to even be tested (using a test with likely cultural bias), the problem of minority identification is magnified (Gagne, 1994).

Most classroom teachers have little or no training in gifted education and are basing their assessment of gifted potential on behaviors that they believe gifted children

possess, such as cooperation, answering correctly, punctuality, and neatness (Pegnato & Birch, 159; Gagne, 1994; Neumeister et al., 2007; Moon & Brighton, 2008). The students they are most likely to identify are the ones that fall into their view of the model student, rather than based on factors that might adequately predict giftedness (Ford, 1995; Moon & Brighton, 2008). "Black students who do not display their gifts and talents like White students may be perceived as deficient rather than different" (Ford, 1994, p. 214). "The assumption of rightness, as related to the achievement gap, often leads teachers to assume that the problem of school failure lies in the students and their families and not in the structure or function of schooling" (Howard, 2006, p. 119).

This systematic failure of teachers to identify gifted students of color exists even when the teacher routinely works with students of diverse racial and socio-economic backgrounds (Neumeister et al., 2007). Neumeister, Adams, Pierce, Cassady, and Dixon (2007) found that despite daily contact with minorities and years of classroom experience, teachers failed to take culture into account when making referrals. Ford (1995) did find that teachers specifically trained in multicultural education practices were more likely to understand the value of different student behaviors, and so were more able to correctly identify gifted students from non-white and/or non-middle class backgrounds rather than assume differences are irrelevant to the educational sphere or even undesirable.

Siegle (2001) proposes that it is culture, not race which is the most significant bias in teacher referral. Ethnicity is easier to identify as a factor for study (Siegle, 2001), while culture is subjective for both the teacher and the student. The interaction between

the teacher's cultural background and that of the student is much more complex, and similar culture may make identification more reliable, since there is a similar point of reference. Proponents of cultural rather than racial bias such as Siegle (2001) point to the lower numbers of GT identification among low SES students.

> These modern researchers would argue that it is not merely ethnicity that creates a minority status within our educational system but that cultural bias towards minorities operates on a more holistic level, with the discrimination being directed at a cultural level encompassing racial, gender, and socioeconomic identity (Courville & DeRouen, 2009, p. 9).

Teachers are projecting expectations based on their preconceptions of student performance based on any number of factors; given the race and SES of the majority of teachers, this practice (although subconscious) establishes a clear advantage for White middle-class students who are fluent in the "language of school" which they share with the teacher (Pegnato & Birch, 1959; Gagne, 1994; Neumeister et al., 2007; Moon & Brighton, 2008).

Students of color and low SES are more likely to be tracked into remedial classes, while those of higher SES will have more opportunity for advanced classes (Ford, 1996). While this may be a result of higher SES students having more extra-curricular opportunities which enable them to advance more quickly in certain subjects, tracking is often permanent, with students rarely given the chance to transfer into a more advanced track, even if they show accelerated improvement (Abell & Lennox, 1999).

> Almost by definition, tracking is a deficit approach to education that segregates diverse learners and perpetuates the impression that African American students are more inept than White students (Harris & Ford, 2004, p. 314).

Ford and Harris (2004) argue that the fundamental underpinnings of tracking are flawed: while tracking proponents argue that student achievement is facilitated by academically similar groupings, they counter that exposure to a diversity of ideas also encourages learning. While tracking may allow students to work in an environment where they are not intimidated by higher-achieving peers, Harris and Ford (2004) argue that students are acutely aware that they have been placed in a lower-ability group and the social stigma attached, and that self-esteem, confidence and motivation may suffer as a result. Trotman (2000) argues that "school districts have a responsibility to ensure that they do not use ability grouping or tracking practices that result in discrimination on the basis of race, color, and national origin (p.2)", yet that is exactly what results when academic tracks are inflexible and become segregated spaces.

When academic tracking is used in a predictive rather than responsive way, it reinforces the deficit thinking of teachers, and makes gifted identification even more difficult (Ford & Harris, 2002). Deficit thinking causes teachers to focus on how students of color are different from their White peers to the exclusion of potential student strengths (Harris & Ford, 1991). Compounding the deficit thinking, Ford (2010) adds the additional detrimental paradigms of *White privilege* and *colorblind ideology*. Privilege makes it difficult for teachers to recognize the inequity inherent in the system, while colorblind ideology creates the illusion of fairness because all students are held to the same standards, which happen to be the behaviors of the dominant racial, cultural and economic group in schools (Ford, 2010).

Student choice may be another factor for the low levels of students of color in gifted and talented programs (Ford, 1998; Courville & DeRouen, 2009). This is not shifting blame to the victim of institutional prejudice, but simply an acknowledgement that even after a thoroughly biased identification process, GT programs themselves might not be what a gifted minority student feels that they need (Ford & Harris, 1991; Ford, 1999; Lampert, 2013). The same cultural biases that prevent student identification are also very likely embedded in the curriculum and instruction of the enrichment program itself (Staiger, 2004). If students identified for GT programs are predominantly white (or Asian), students of color may believe that their involvement with such programs could be construed by their non-gifted peers as "selling out." Staiger (2004) reinforces this belief through a series of interviews with gifted students of color who are vocal about the conflict they feel between their cultural identity and their status as gifted learners. In the words of one such student, "giftedness was equivalent to whiteness" (Staiger, 2004, p. 162). The need for social acceptance, even if it means sacrificing a challenging, interesting and appropriate educational experience, is especially prevalent among teenagers, who are navigating ever more complex social dynamics (Ford, 1999).

There are possible solutions to this disparity in identification practices. Nonverbal tests such as the Raven's Progressive Matrices (colloquially known as "The Ravens") and the Naglieri Nonverbal Ability Test (NNAT) (Naglieri & Ford, 2003) have been introduced by many school districts in an attempt to reduce bias. The Kaufman Assessment Battery for Children has also shown an even distribution across ethnic and SES demographics (Naglieri & Ford, 2003). While these tests show promise, Lohman

(2005) points out that an assessment that shows no cultural, economic or racial bias still must yield valid results to be useful. Or, as Courville and DeRouen (2009) put it, "just because an assessment gives results that are distributed in the manner which we desire does not mean that the assessment has appropriate content validity" (Courville & DeRouen, 2009, p. 16).

Other alternative assessment tools include multi-dimensional assessments such as portfolios, biographical inventories, observation checklists, etc., dynamic assessment, assessing multiple intelligences, and performance-based assessment. Using these instruments in conjunction with achievement and intelligence tests would cast a wider net (Naglieri & Ford, 2003) and provide more opportunities for potentially gifted students to demonstrate their abilities.

Regardless of the tool utilized for measurement, social barriers and psycho-social factors must be taken into account. Expanded multicultural and gifted education for classroom teachers would reduce the bias implicit in teacher referrals. Embracing a more inclusive definition of giftedness, such as Sternberg's Triarchic Intelligence model, would allow for more variety in learning demonstrations.

If a multi-faceted portfolio-based assessment model is adopted, it must be used as a way to allow multiple pathways into gifted identification, rather than a series of sequential hurdles that make identification more difficult. A multitude of different assessments should be able to provide evidence and alternative points of entry, but should never become additional requirements, or else the purpose of a multi-dimensional identification model is moot.

History of Curiosity Research

Curiosity has been used as a descriptor for gifted students as a whole (Colangelo, 2003; Clark, 2008), although it has been presented as conventional wisdom rather than anything that has empirical backing. Henderson et al. (1982) asserted that curiosity declined with age in non-gifted students and increased with age in the gifted population, although the study conducted was focused on daydreaming rather than use of psychometric measurement.

William James, the "Father of American Psychology" described two instinctive types of curiosity. The first type is sensory: a combination of excitability and anxiety toward exploring objects in the environment for the purpose of enjoying their novelty. The second type is scientific (i.e., cognitive) curiosity: the actual ways humans conceive of objects to recognize knowledge gaps, which, when resolved, resulting in feelings of pleasure and advance scientific knowledge (James, 1890).

John Dewey, the "Father of Modern Education," described a three-factor model of curiosity. His first type was Physical, much like James' sensory-type curiosity: a physiological restlessness that he equated to an animal or child's tendency play with no particular goal in mind. Dewey's second type is Social and defined as unique to humans and activated by interactive stimuli. This is best illustrated by the child's endless array of "Why?" questions, it is simply an attempt to acquire more items of information that are not necessarily rationally connected. Dewey's third factor of curiosity is Intellectual and is aroused when an individual believes there may be more to information or facts than

meets the eye. This includes both solving problems and acquiring knowledge in a systematic way (Dewey, 1910).

Dewey distinguished between curiosity and interest. When information is lacking, curiosity occurs and can be turned into interest if the conditions are right. He also warned that intellectual curiosity and the motivation to learn could be easily squelched by excessive dogmatism, inflexibility, the obsession with routine, and ambivalence (Dewey, 1910).

Systematic scientific examination of curiosity began in the 1950s and 1960s (Greenberger, Woldman & Yourshaw, 1967). Working from a largely Behaviorist perspective, Dr. Daniel Berlyne published experimental and theoretical work regarding curiosity (Berlyne, 1954). Berlyne attempted to create a cohesive and concise definition of curiosity that could be measured and tested. Berlyne proposed a distinction between perceptual and epistemic curiosity. Perceptual curiosity is situational, and is a state of arousal triggered by introduction of novel stimuli, which is gradually extinguished by continued exposure (Berlyne, 1954). Berlyne observed that stimulus-seeking behaviors were present in both humans and animals. He proposed that all animals actively seek out conflict in order to experience elements of novelty, surprise, change, ambiguity, incongruity, complexity, blurredness, and power to induce uncertainty (Berlyne, 1960). Subsequent research has suggested that perceptual curiosity involves seeking sensory experience (Collins, et al. 2004). Epistemic curiosity, however, is a uniquely human characteristic, describing the motivation to discover information (Berlyne, 1954, 1960).

Another axis of curiosity that Berlyne (1954) established was the differentiation between the experience of curiosity as specific or diversive. Specific curiosity pertains to a particular locus: solving a puzzle, for instance, or an obsession with a particular hobby. Diversive curiosity is more generalized and broad. Diversive epistemic curiosity, then, is a broad desire to learn new information, regardless of the subject, while specific epistemic curiosity is represented by a strong desire to know everything about a given subject (Berlyne, 1954). Likewise, specific perceptual curiosity is an interest in a given novel stimulus, while diversive perceptual curiosity is embodied in an animal who constantly scans its environment for potentially new elements (Berlyne, 1954, Litman & Spielberger, 2003). Berlyne speculated that specific and diversive curiosity could be observed in alternation behavior, visual exploration, manipulation and play, and proposed that some of these behaviors were motivated by a boredom drive, i.e. an attempt to create an optimal level of mental stimulation rather than seeking more information about any specific object or subject, and a curiosity drive which includes the pursuit of a specific rather than general mental stimulus about an object or subject (Greenberger et al., 1967). In their experiment with visual focus, Greenberger, Woldman and Yourshaw proposed that lingering attention on complex images was a result of the boredom drive while a visual interest in incongruity was the domain of curiosity (Greenberger et al., 1967). Byman, on the other hand, proposed an alternative model that classified the behaviors previously considered diversive curiosity to be a sensation-seeking trait rather than the boredom drive (Byman, 2005).

Berlyne and his contemporaries (Greenberger et al., 1967; McReynolds et al. 1961, Maw & Maw, 1964) were concerned primarily with crafting theories of the human desire to solve puzzles and mysteries, and to seek out new sources of information. In his 1994 review of the state of curiosity research, Loewenstein notes that most theoretical constructions of curiosity from the 1960s were focused on curiosity as an innate trait, rather than being situationally-based (Loewenstein, 1994). In the absence of previous experimental research into curiosity, literature reviews examined historical understandings of curiosity that predated the establishment of psychology as a discipline. Curiosity was described in the research as a desire to acquire information for no given purpose, as a passion, defined in this case as an emotional state divorced from reason, and as a need where terms like "hunger" and "thirst" could be ascribed (Loewenstein, 1994).

Berlyne's (1954) definitions form the basis of almost all subsequent research on curiosity and led to the development of the first scale of curiosity measurement, the Ontario Test of Intrinsic Motivation (OTIM) in the early 1970s (Evans, 1971). This instrument was followed by the Melbourne Curiosity Inventory (MCI) and the State Epistemic Curiosity Scale (SECS) (Loewenstein, 1994). While these pen and pencil self-report assessments have strong internal consistency, and are based on the theoretical underpinnings of Berlyne's epistemic curiosity theory, they do not agree on which behaviors are authentic expressions (Loewenstein, 1994) of curiosity.

Like Berlyne, McReynolds, Acker and Pietila (1961) also emerged from the Behaviorist perspective of psychology. In their work, they make reference to the studies in exploratory behavior and novelty-seeking behavior in animal subjects. They conducted

systematic observations of children near the age of 11 with varying degrees of "maladjustment" as they manipulated a series of objects without looking at them, scoring certain types of actions, comments and questions to try to gauge the student's curiosity about the object in question and concluded that maladjustment was negatively correlated with expressions of curiosity McReynolds, Acker & Pietila, 1961). From those findings they proposed that anxiety might hinder classroom tasks that rely on curiosity (McReynolds, Acker & Pietila, 1961). Penny (1965) also conducted research which indicated an inverse correlation between manifest anxiety and reactive curiosity (Penny, 1965).

Maw and Maw (1964, 1972) utilized multiple instruments to create a composite measure of curiosity. Their studies began in 1964 with a battery of eleven types of items, including riddles and intentionally nonsensical sayings. While their initial tool found very little variation in the curiosity levels of their fifth grad age subjects, they incorporated elements of their experimental battery into an evenly-weighted pencil self-report, peer review, and teacher review to generate a score used for their correlational studies in their follow-up study (Maw & Maw, 1972). Their research found a moderate correlation of .61 between their composite curiosity score and IQ test score (Maw & Maw, 1972). Maw and Maw (1972) also found positive correlations between epistemic curiosity and effectiveness, loyalty, reliability, accountability, intelligence, creativity, degree of socialization, tolerance for ambiguity, sense of personal worth, and responsibility. Coie (1974) utilized similar methodology to the Maw and Maw study to support a correlation between curiosity and intelligence, finding similar results, but also casting doubt on the

teacher-reported element of the composite curiosity scale. He found that teacher assessment of student curiosity was, in fact, simply assessing intelligence directly rather than curiosity as self-reported or judged by peers (Coie 1974).

Not all research found a correlation between curiosity and other factors. Penney and McCann (1964) found no correlation between their measure of curiosity as measured by the Children's Reactive Curiosity Scale and IQ or, incidentally, the likelihood of children to lie, as measured by items drawn from Children's Form of the Manifest Anxiety Scale (McCann, 1964). Camp, Rodrigue and Olson (1984) compared the results of the Ontario Test of Intrinsic Motivation (OTIM) and the Experiment Descriptions Inventory (EDI), a self-report inventory where respondents rank previously reported psychological experiments and their results in terms of surprisingness, perceived value, and the desire to gain additional knowledge about the research area, with the age of adults in three age categories (25-35 years, 45-55 years, and 65-75 years). They found a significant relationship between age level and curiosity aroused by boredom measured by the EDI in the 25-35 and 45-55 range, but no significant relationships between age level and other curiosity measures. No significant results were found in the 65-75 age group (Camp, Rodrigue & Olsen, 1984).

Engelhard and Monsaas (1988) demonstrated that curiosity as a trait may decrease over time, either due to naturally-occurring maturation or as the result of exposure to traditional school environments; their research showed a statistically significant faster rate of curiosity decline in students in Catholic school versus those in public school (Engelhard & Monsaas, 1988). Kreitler, Zigler and Kreitler (1984) assessed a sample of

75 first-graders for manipulatory, conceptual and complex dimensions of curiosity in a discrimination-learning task. The researchers graded the task for both correct responses and for evidence of variability, systematic patterning and perseveration (Kreitler, Zigler & Kreiter, 1984). The findings showed that degrees of curiosity had a significant effect on the way that students approached problems in terms of the strategies they utilized (Kreitler, Zigler & Kreiter, 1984).

Trait theory (also called dispositional theory) has been used as a lens to view earlier models of curiosity. Francis Galton proposed that human behavior could be defined by a comprehensive list of personality traits. Gordon Allport built on Galton's ideas in the 1930s and apocryphally devised a threefold model of human "dispositions" after meeting with Sigmund Freud (Ewen, 2003). The premise of this theory, that humans can be coded and defined by relatively stable and permanent traits, was subsequently developed by Raymond Cattell into the 16PF Questionnaire, J.P. Guildord into Structure of Intellect, Henry Murray's System of Needs, Hans Eysenck's Three-Factor Model, Lewis Goldberg's Big Five Model, and the proliferation of internet quizzes. The antithesis of trait theory is the belief that personality traits are transitory and temporary, that they are states of mind rather than fixed elements of a human personality.

Boyle (1989) applied factor analysis to Berlyne's conceptions of specific vs. diversive and perceptual vs. epistemic curiosity to create a global state-trait model. The global state-trait model describes curiosity as both a trait, C-Trait, and a state of being, C-State; while the C-Trait is an inherent element of a person's personality, it is also built up by positive experiences in the C-State (Boyle 1983). Boyle, Richards and Baglioni used

magic tricks and illusions to try to stimulate C-State and then found that instruments used to measure C-Trait did, in fact, show an increase in curiosity, at least temporarily, lending evidence to epistemic curiosity being malleable (Boyle et al., 1993).

Reio, Petrosko, Wiswell and Thongsukmag (2006) proposed a three-factor model for conceptualizing curiosity. Using factor analysis on a number of curiosity inventories administered to 369 college students, they reduced the numerous dimensions down to cognitive curiosity, physical thrill-seeking, and social thrill-seeking. Cognitive curiosity is an information-seeking trait, measured with agreement/disagreement with statements like, "I like searching for answers" and "I like thinking a lot about a new idea." Physical thrill-seeking is a measure of physical risk-taking, measured with statements like "I like to have new and exciting experiences and sensations even if they are a little frightening, unconventional, or illegal." The final factor in this three-fold model, social thrill-seeking, is predicated on the premise that humans seek novelty and stimulation through not only physical activities, but also through people and social activities that can involve risk (Reio et al., 2006). They postulate that there is no single general curiosity factor, as predicted by Berlyne (1966), but rather separate cognitive and sensory stimulation-seeking drives (Reio et al., 2006).

Litman (2004) and his collaborators proposed the wanting-liking model as a theoretical framework for looking at curiosity, which supposes two separate neural motivations for curious behavior. Interest-based, I-Type, curiosity is triggered by the positive reinforcement of learning new things as a pleasurable activity. Interest-based curiosity is defined by enjoyment in discovery (Litman, 2005; Litman, Hutchins &

Russon, 2005), while Deprivation-based, D-Type, curiosity is defined by anxiety over things left ambiguous, unsolved, or undiscovered (Litman, 2004). Deprivation-based curiosity is a desire motivated by unpleasant emotional states when it isn't satisfied (Litman, 2008). This theoretical framework is analogous to the relationship people may have with food: eating delicious food may be pleasurable, but hunger is an unpleasant motivator to eat (Litman 2005, 2008, 2010; Litman & Jimerson, 2004; Litman & Silvia 2006; Litman & Spielberger, 2003). While Litman conducted a number of studies to test the validity of his measures and to test his hypothesis about the construction of curiosity (Litman, 2004; Litman, 2008; Litman, 2010; Litman, Crowson & Kolinski, 2010), there have been no correlational studies between this new theoretical framework of curiosity and cognitive assessments.

Quantitative Measure: Need for Cognition Scale

The Need for Cognition Scale, created in 1982, is a psychometric instrument to measure "the tendency for an individual to engage in and enjoy thinking" (Cacioppo & Petty, 1982, p. 116). The original scale included 34 questions but was shortened to 18 items by the tool's creators (Cacioppo & Petty, 1984). The Need for Cognition Scale appears to be a valid and reliable measure of individuals' tendencies to pursue and enjoy the process of cognition, (Cacioppo & Petty, 1982; Cacioppo, Petty, Feinstein, & Jarvis, 1996; Cacioppo et al., 1984; Sadowski, 1993; Sadowski & Gulgoz, 1992) and has been positively correlated with epistemic, but not diversive, curiosity (Olson et al., 1984; Mussel, 2010; Litman & Mussel, 2013). Gender does not seem to be a factor for the Need for Cognition scale, and scores on this instrument are apparently not impacted by whether

or not the individuals are trying to paint a favorable picture of themselves (Cacioppo & Petty, 1982; Olson et al.,1984)

Table 1 (Olson et al., 1984, p. 73) shows how the Need for Cognition scale correlates with other methods for measuring epistemic curiosity, specifically the Ontario Test of Intrinsic Motivation (Evans, 1971), the Sensation Seeking Scale (Zuckerman et al., 1964, Zuckerman, 2007), the Melbourne Curiosity Inventory (MCI; Naylor, 1981), the Academic Curiosity Scale (Vidler & Rawan, 1974, 1975), Spielberger's unpublished State-Trait Curiosity Inventory, State-Trait Anxiety Inventory, and State-Trait Anger Expression Inventory (Spielberger, 1983; 1988), and the ACT scores of the subjects.

The Need for Cognition Scale measures the factor that this research seeks to isolate, but also a number of others; it is analogous to a hammer rather than a scalpel. There is a strong correlation between the Need for Cognition and specific curiosity: that is, a continuing interest in one or more intellectual topics. The scale also correlates with an interest in complexity and abstract problem-solving, the broadly defined dispositional trait of curiosity, and to a lesser extent a state-based and specifically academic curiosity. It is the relationship to trait-based curiosity that is most pertinent in this case, although the other aspects of curiosity that are correlated are also related and valuable.

Table 1 (Olson et al., 1984, p. 73)

Pearson Correlation with Scores on Need for Cognition

Variable	*M*	*SD*	*r*
Ontario Test of Intrinsic Motivation			
Specific Curiosity	53.02	15.67	.50
Ambiguity	17.82	5.43	.45
Complexity	16.93	5.73	.50
Novelty	17.26	5.58	.45
Outdoor	5.71	2.05	.17
Mechanical	5.58	2.86	.33
Computational	4.41	2.73	.44
Scientific	4.13	2.65	.44
Persuasive	5.68	1.92	.29
Artistic	4.34	2.60	.19
Literary	5.63	2.11	.40
Musical	4.78	2.35	.25
Social Service	6.96	1.63	.47
Clerical	4.70	2.14	.39
Thinking	15.49	5.99	.59
Consultation	17.27	5.41	.37
Observation	19.17	5.44	.44
Diversive Curiosity	5.58	1.84	.01
Sensation Seeking Scale	18.73	6.30	.25
Thrill and Adventure Seeking	7.26	2.44	.31
Experience Seeking	4.38	2.13	.41
Disinhibition	4.53	2.56	-.03
Boredom Susceptibility	2.48	1.72	.03
Melbourne Trait Curiosity	56.63	12.82	.55
Melbourne State Curiosity	51.91	12.95	.45
Academic Curiosity Scale	29.76	9.10	.68
Spielberger's Trait Curiosity	28.59	4.46	.67
Spielberger's State Curiosity	27.66	5.45	.55
Trait Anxiety	19.48	4.42	-.27
State Anxiety	17.29	5.43	-.23
Trait Anger	20.36	5.23	-.11
State Anger	12.06	4.66	-.03
American College Testing (ACT)	18.51	5.36	.31
Social Desirability	5.01	2.86	.16
Sex			.01

Since its introduction in Cacioppo & Petty's 1982 study, the Need for Cognition scale has been used frequently, both by itself and in conjunction with other psychometric measures (Akpur, 2017; Keller et al., 2016) and has undergone rigorous examination and analysis (Osberg, 1987; Sadowski & Gulgoz, 1992; Gulgoz, 1996; Flaces et al., 2001; Lord & Putrevu, 2006; Zhang, Noor & Savalei, 2016).

For normative scores, this study used Culhane, Morera and Watson's 2006 study of 241 American Hispanic (M age = 19.69, *SD* = 3.53), and 367 Anglo (M age =19.16, *SD* = 3.47) undergraduate students, due to the similarity in population to that of the group on which the I/D was most recently normed (Lauriola et al., 2015). In that study, the mean for the NFC was 41.85 (*SD* = 9.03) for Hispanic and 40.30 (*SD* = 9.35) for Anglo subjects, showing that there is no substantive difference between the two sets of respondents. Table 2 (Culhane, Morera & Watson, 2006) shows the normative scores against which this study was compared, henceforth referred to as historical data.

Table 2 (Culhane, Morera & Watson, 2006)

Normative Scores for NFC Scale

NFC Scale	Mean	Standard Deviation
(Hispanic)	41.85	9.03
(Anglo)	40.30	9.35

Quantitative Measure: Interest/Deprivation Scale

The Interest-based and Deprivation-based Interest/Deprivation Scale is designed to differentiate between styles of curiosity more than act as a measure of curiosity overall. If the Need for Cognition Scale is analogous to a hammer, the Interest/Deprivation Scale is the contrasting scalpel. It allows a more nuanced approach to examining the way curiosity is manifested, according to the wanting-liking theory of curiosity (Litman & Silvia, 2006; Litman, 2008; Litman, 2010), which can be reinforced further with the application of qualitative methods (Creswell, 2010).

While not as referenced as the Need for Cognition scale, this instrument has demonstrated acceptable internal consistency on the basis of alphas, mean inter-item correlations, and mean item-total correlations. Additionally, the validity has been demonstrated on the basis of positive correlations with other curiosity instruments and minimal relationships with measures of other constructs (Litman & Jimerson, 2004; Litman & Silvia, 2006; Litman & Spielberger, 2003). The Interest/Deprivation Scale has been administered in several studies (Litman, 2006; Litman & Silvia, 2006; Litman, 2008; Litman, Crowdon & Kolinski, 2010; Litman & Mussel, 2013; Lauriola et al., 2015), most recently in Lauriola, Litman, Mussel, De Santis, Crowson, and Hoffman's 2015 study of a population of 218 American (M age = 20.81, SD = 3.07) and 56 German undergraduate students (M age = 20.95, SD =3.07). The means and standard deviations are listed below. Table 3 illustrates the scores against which this research project will be measured (Lauriola et al., 2015), while Figure 1 shows the inter-factor correlation, factor

loadings and error path coefficients for the items used on the Interest/Deprivation Scale instrument.

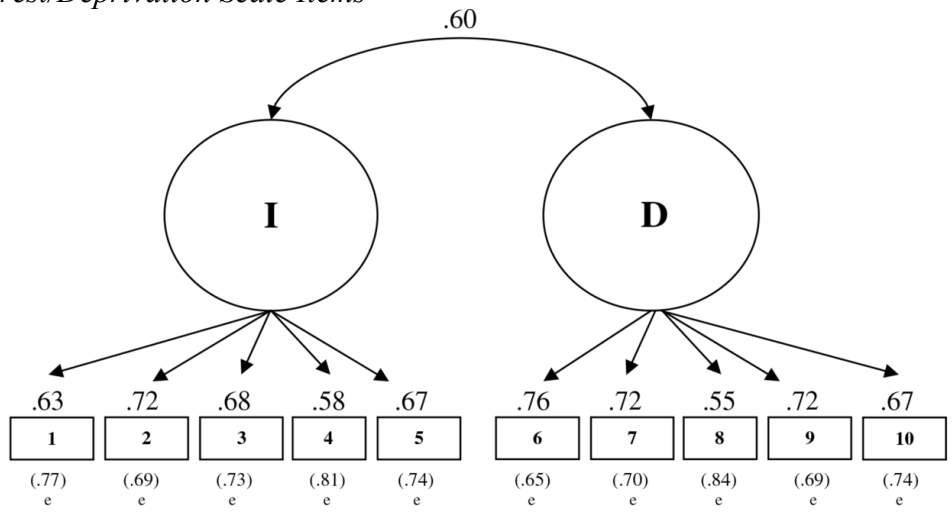
Table 3 (Lauriola et al., 2015)

Normative scores for Interest/Deprivation Scale

Scale	Mean	Standard Deviation
Interest/Deprivation Scale: I-Type EC	14.35	3.04
Interest/Deprivation Scale: D-Type EC	11.14	3.05

Figure 1 (Litman, 2008)

Diagram of Inter-factor Correlation, Factor Loadings, and Error Path Coefficients for Interest/Deprivation Scale Items



I-type
1. Enjoy exploring new ideas.
2. Find it fascinating to learn new information.
3. Enjoy learning about subjects that are unfamiliar to me.
4. Enjoy discussing abstract concepts.
5. Learn something new, like to find out more about it.

D-type
6. Hours on a problem because I can't rest without answer.
7. Brood for a long time to solve problem.
8. Conceptual problems keep me awake thinking.
9. Frustrated if I can't figure out problem, so I work harder.
10. Work like a fiend at problems that I feel must be solved.

Qualitative Measure: Gateway Approach to Interviewing

The Gateway Approach to interviewing is a method of qualitative data collection which originated as a way to collect the emotional accounts of survivors of the 1999 Columbine High School shooting. The Gateway Approach emphasizes techniques to encourage interviewees to tell their stories rather than answer a series of questions. Interview questions are included as suggestions to start a conversation, and the responses are then paraphrased by the interviewer after the interview is complete. This technique makes the subject complicit in the proceedings, since they are asked to verify the condensed and paraphrased elements of their own narrative. Each subject is interviewed twice or three times, with a chance to see the paraphrased responses between each interview; this refractory period allows the interviewee to reflect on what they feel was misrepresented or left unsaid, as well as plan on how to direct their narrative for the later interviews (Mears, 2009)

The interview protocol is left intentionally vague, to accommodate the interviewee telling a story that becomes tangential but still revealing and important. However, with that in mind, the protocol has certain core questions that can anchor the discussion and bring the conversation back to the topic of curiosity. The interview opens in a transparent manner*:* "I'm interested in learning about conceptions of curiosity and would like to hear how you perceive it." This establishes the nature of the discussion, but also puts the interviewee on the spot to define something that they may very well have not given a great deal of thought to.

Hopefully, the interviewee's response organically leads to other questions, but should that particular conversation thread dry up, the interviewer will ask the interviewee to compare their current conception of curiosity to that of a child, hoping that this will trigger some insight into the changing nature of cognitive processes. Once the interviewee has engaged in reflection about childhood, the interviewer asks about the emotions attached to discovery, exploration and novelty. This pertains explicitly to the Interest-type curiosity described by Litman (2006).

Engaging in emotional reflection may not be particularly comfortable, so the interviewer may guide the discussion to specific hypothetical examples, and may drop the line of questioning entirely to ask about the feelings of resolution that accompany solving a problem or discovering a new thing: "What does it take for you to feel your curiosity about something has been resolved?" While this is still a question about emotional status as it relates to curiosity, it is also a more specific question, which may be easier for the interviewee to answer. It also aims to unveil information about Deprivation-based impulses (Litman, 2006). Assuming that the interviewee's response doesn't take the question in a whole new area, probing further about unresolved curiosity is the next obvious step.

When the interviewee's narrative strand has been pursued to its organic end, asking questions designed to tease out the interviewee's feelings about states of mind and curiosity as a permanent trait should come next. "Are there times you feel more curious than others?" leads naturally into this discussion, which addresses the state vs. trait aspect of curiosity (Boyle, 1989). From there, the interviewer can engage in some questions,

either direct or indirect about the interviewee's opinion about the value of curiosity versus any potential detriment it may have. The question, "What do you think of the saying, 'curiosity killed the cat?'" is a jumping off point to encourage the interviewee to discuss these sorts of topics.

For the second interview, any topics or ideas that have come up since the first interview, by either interviewer or interviewee, should be addressed first. Once that has been resolved, the interviewer may return to the question of state vs. trait curiosity by asking, "do you feel that your level of curiosity has changed over the course of your lifetime, or has it generally remained the same?"

A series of questions specifically aimed at the Interest and Deprivation aspects of curiosity are introduced at some point: "How do you feel when you can't solve a puzzle or problem?" and "Do you ever feel bored? How do you deal with boredom?" Hopefully those questions will reveal rich, deep narratives that can be compared to the quantitative data. This addresses the Interest and Deprivation aspects of curiosity (Litman, 2006).

The last few scripted questions are specifically about school and education in general: "What do you think the purpose of education is?" "What do you think the purpose of education **should** be?" "Do you find school to be challenging?" "Do you find school to be interesting or rewarding?" Any or all of these questions can be used to entice the interviewee to discuss their curiosity in a formal setting, and whether their curiosity is in alignment or runs counter to the current system of education. These questions are designed around Engelhard and Monsaas' 1988 study about the diminishing nature of curiosity in educational settings.

The conclusion of the interview asks the interviewee to reflect on the discussion that has occurred, both in the first and second interviews, and bring up anything that stood out for them. This closing piece turns the interview back on the interviewer and asks them to become the questioner, but also to summarize and highlight the nature of the interview as a whole: what was consequential to the interviewee may not have seemed so to the interviewer.

Summary

The field of gifted education has historically been focused on attempts to measure intelligence. Due to the contentious and conflicting definitions of intelligence, it has been difficult to pin down a valid culturally neutral assessment. An ugly history of cultural supremacy has led to assessments that favor the hegemony that created and endorsed these tests. Unfortunately these tests have traditionally been the backbone of gifted education.

As a result, there exists a large unrecognized body of gifted children, mostly non-white and/or of low socio-economic status. The current identification methods, whether they rely on culturally-biased intelligence tests or on recommendations from teachers who lack the cultural context and training in gifted education necessary to make accurate judgments, do not serve these students. While the current trend in gifted identification focuses on multi-faceted assessment tools, this collection of a "body of evidence" requires a high quantity and variety of data in order to be effective.

By contrast to investigations into the nature of intelligence, curiosity research has been a relatively minor branch of psychology and psychometrics. Like intelligence, there

are competing theories as to the nature of curiosity, but there are valid and reproducible instruments for measuring aspects of it. If there was, as conventional wisdom states, a higher preponderance of curiosity in gifted children, than it could be included as part of a multi-faceted gifted assessment, perhaps identifying otherwise underrepresented students.

Chapter 3: Methodology

Research Questions

Is epistemic curiosity positively related to giftedness?

How does epistemic curiosity manifest in gifted populations?

To what extent does the quantitative and qualitative data converge? How and why?

Restatement of Purpose

The purpose of this study was to explore the use of a measure of curiosity assessment as a potential identification tool for gifted education. Established instruments for measuring curiosity were administered to a sample of gifted adolescents and a sub-sample of non-gifted adolescents. The means of both samples were compared to each other, as well as historical data for the instruments used. A follow-up second phase involved interviewing the outliers from the quantitative study, as both an explanatory element and potential tool for triangulation.

Procedures

76 gifted adolescents and 36 non-gifted adolescents were given the Interest/Deprivation Scale and the Need for Cognition Scale. Data was analyzed both to compare the means of the two groups to each other, and also to data drawn from previously published research (Culhane et al., 2006; Lauriola et al., 2015), as well as to

determine the highest and lowest Interest-type respondent, the highest and lowest Deprivation-type respondent, and the highest and lowest Need for Cognition respondents. These high and low respondents were invited to participate in the second phase of the research: in-depth interviews to generate qualitative data about the subject of curiosity. After qualitative analysis, the two strands, quantitative and qualitative, were compared to check for congruity.

A convergent parallel mixed-methods design was best-suited to obtain complementary quantitative and qualitative data about the same subject (Creswell & Plano Clark, 2001). While the quantitative research may reveal trends in the participant group, it does not explain or expound on that inquiry, which is essential if the data are to be used as part of a future educational practice (Creswell & Plano Clark, 2010). Before progressing to the qualitative strand, analysis of the quantitative data was conducted, both to establish which students to include in the qualitative sub-sample of high and low outliers for interview, as well as potentially to dictate additional questions to include on the interview guide. Whether the quantitative and qualitative elements are used in an explanatory fashion or to triangulate research results, they are both necessary if the data are to be useful to gifted specialists, school administration, or curriculum theorists (Creswell & Plano Clark, 2010). By using mixed methodology, the study can perform both an explanatory and exploratory purpose. Even before analysis, the results of one line of inquiry, such as quantitative data, can inform another: interviews, for instance (Creswell & Plano Clark, 2001).

Simply finding a difference in curiosity between gifted and non-gifted students does not in any way explore causation. Without a deeper exploration of the expressions of curiosity in gifted students, it is simply a statistical item of interest with no direct application or explanation. The addition of a qualitative strand to correlational research on curiosity compensates for the weaknesses inherent in using strictly quantitative methods (Creswell, 2008). Though reliable and valid in other populations, the Interest/Deprivation Scale is strictly a quantitative tool and will be supplemented with additional exploration of the concepts through direct human interaction and observation. The quantitative data alone may not reveal enough about a behavioral trait as loosely defined as curiosity or particularly inform which students are "gifted" and which are not. The qualitative component fills in that gap and allows for curious students to fully express the nature of the trait, allowing for richer, more insightful data.

Quantitative Data

The initial information gathering for this study is quantitative, and is concerned with generating empirical data from psychometric instruments in order to look for a difference in the measured traits between specific gifted and talented and non-gifted students.

Asynchronous cognitive development is the norm among gifted students (Colangelo 2003), and generalizations about student abilities or perceptions are difficult, as evidenced by the myriad of attempts to define giftedness. Gifted students are outliers, often in the literal sense that they are standard deviations above their peers in one or more areas. In order to ensure that the sample was representative of the demographic factor that

the study desired, in this case giftedness, the research participants were students who had been identified through means which included cognitive tests as part of the multi-faceted assessment. Both the school districts that agreed to participate in this study utilize "body of evidence" portfolios for gifted identification, but cognitive assessments were included as a necessary element in those collections of data.

The identification procedures of one of the two districts was opaque beyond the assurance of a multi-dimensional assessment procedure, but the other participating district requires a cognitive test in the 95th percentile, an academic assessment in the 95th percentile, and a teacher observation scale in the 95th percentile in order to qualify. The majority of participants originated from the latter district.

The psychometric instruments used for the quantitative component of this study were designed to measure various states or traits of curiosity and academic motivation. The Need for Cognition Scale should provide a rough guide of epistemic trait-based curiosity. The Interest/Deprivation Scale, on the other hand, measures two similar and related factors: Interest-based curiosity, where exploration and novelty is pleasurable, and Deprivation-based curiosity, where unresolved questions and problems cause anxiety (Litman & Silvia, 2006). There are only 28 items on the instrument, and each one should take less than 30 seconds to complete, so the entire instrument can be administered in around 14 minutes. Neither of the instruments used for this research have rigorous administration protocols; most surveys were given in paper/pencil versions, although a digital/online survey component was included to facilitate more efficient data collection.

Qualitative Data

The collection of qualitative data is essential for explaining, exploring, and triangulating the results of the empirical research (Creswel & Plano Clark, 2010). The Gateway Process calls for two or three separate 50-minute modified oral history interviews to disclose meaning and significance that the interviewer takes from the subject matter (Mears, 2009).

The selection of interviewees was to be conducted without the interviewer knowing which interviews were aligned with which curiosity type and its level, but this proved to be challenging when respondents opted not to participate in the qualitative research. The upper outliers were eager to be interviewed, even though they had only a vague conception of what kinds of topics we would be discussing (they were not informed why they had been selected from the sample). On the other hand, the lower outliers in two of the three categories opted not to participate further. When the next lowest was contacted, they also chose not to participate.

This pattern repeated five times for each of the I and D type curiosity scales, until the choice was to interview someone who was not a statistical outlier or no one at all. The exception to this frustrating development was the lowest outlier in the Need for Cognition scale, who was encouraged to participate by his mother and gave insightful responses that stand in stark contrast to those of the highest I-Type, D-Type and NFC scale scorers. It was decided that since the purpose of the research was to see what curiosity "looks like" in a teenage population rather than what it *doesn't* look like, it was more essential to

secure quality interviews with the student respondents with the highest curiosity than dwell on those with low scores.

Of the four subjects interviewed (three high, one low), all were within the age range of 13-18, two were younger (finishing middle school or just starting high school) and two were high school seniors. All were in public school settings, and none of them knew each other. In the population of high scorers, two identified as male and one identified as female; all three had been in gifted and talented programming. The one low scorer was also male, and was not identified as gifted.

All interviews were audio recorded with the subject's permission and archived in locked or password-protected facilities accessible only to the researcher. Transcripts produced from these recordings were similarly protected. All quotations and attributions were identified only by pseudonyms, and confidentiality of sensitive disclosures was maintained. The interviews were conducted in a quiet room whenever possible and recorded using a bi-directional microphone into a laptop computer. They were transcribed between interview sessions and the content paraphrased, so that the subjects could check the record for accuracy and clarity.

In accordance with the Gateway Method, a series of questions were prepared as an initial way of getting the participants to open up, but the goal was to get them to lead the dialog. Questions from the interviewer were created on the spot to encourage more extrapolation from the interviewee rather than generating a series of answers to static questions. In all cases, this was effective, although the technique took some practice and the first interview conducted lacks as much embellishment as subsequent ones.

The interviews followed the interview guide, Appendix B, but were open to a divergent interviewee-guided narrative to generate authentic and expressive data. Whenever the interviewee seemed to have exhausted a line of questioning from the open-ended guide, the interviewer was able to touch on questions that a given participant scored particularly high on; for instance: "You said that you strongly agree with the statement 'I enjoy exploring new ideas.' Can you give me an example of a time when you did that?" Ultimately, however, the Gateway Approach (Mears, 2009) prioritizes interviews driven largely by the participant, with questions being a touchstone designed to solicit the participant to talk about their personal interests. The goal was to generate textual data that could be examined for themes surrounding curiosity and its manifestations (Mears, 2009). The interview data were examined both to determine any shortcomings or misunderstandings on the psychometric scale items, and also to determine if there were distinct perspectives on curiosity and curious behavior among respondents.

Interpretive techniques drawn from Mears (2009) were also applied to the transcription in an attempt to distill the salient information from an extended narrative. After transcription of the interviews, interviewees were given access to a member check (Mears, 2009) to verify both accuracy of the recording and the interpretations of their responses.

Participants

Quantitative

Research was conducted with 76 high school adolescents in the 9th through 12th grade or of comparable age who had previously been identified as gifted and talented and received some degree of gifted programming through their school, as well as a sample of 36 non-gifted adolescents with otherwise similar demographics.

Adolescents were chosen so that existing instruments for measuring curiosity could be utilized. The Need for Cognition Scale and the Interest/Deprivation Scale both have established normative values from a similar demographic from previous research. While it would have been more directly useful to collect curiosity data on early elementary grades, when gifted identification usually occurs, there was no established measurement tool for that age and no historical data to compare results to.

Respondents were recruited through cooperation with two Colorado school districts that passed information about the study to their gifted families, although word-of-mouth meant that some members of both the gifted and non-gifted samples were from outside those districts. As a result of asynchronous development, some of the respondents had levels of education that were not in alignment with their age: for instance, there were two 16-year olds who were enrolled in college full time. Of the non-college age students, all were enrolled in public schools.

Finding a non-gifted sample proved to be unexpectedly challenging: it was hard to solicit responses to a study when it was specified that it was for explicitly "non-gifted" students. As a result, a question about whether the respondent had ever

been identified as gifted and talented or received gifted enrichment programming was added to the survey before it was circulated to the general population in the cooperating school districts. With this question in place, an additional 30 gifted respondents were identified while data was collected on the non-gifted population.

The study included 57 female-identifying respondents and 55 male-identifying total, while the gifted-specific sample included 19 female-identifying respondents and 34 male-identifying respondents. No data was collected on socio-economic status or ethnicity: it was recognized that there wouldn't be a large enough pool of any given demographic in a study of only slightly over 100 participants to draw meaningful data from. While this study has as its goal a better method for identifying underrepresented, it wasn't feasible to generate a valid sample of gifted students of color or low SES within the constraints of this study, exactly because they are underrepresented.

Qualitative

Six participants were selected to include a representative sub-sample of students who scored extremely high or extremely low on each of the three measures: Interest-type, Deprivation-type, Need for Cognition, with the highest-scoring participant selected from each category. Originally, this process was going to be conducted by a research assistant so that the interviewer didn't know how the interviewee had scored, and thus wouldn't be biased by the quantitative data. This process was found to be impossible, and as it became difficult to find participants willing to continue into the second phase of research, the researcher selected the highest and lowest responses from the data set without the double blind.

Additionally, two median responses were originally intended for the interview methodology, but it was decided that it was more important to capture the differences between the I-Type, D-Type and NFC types of curiosity rather than record the responses of median responses from the quantitative data.

It became difficult to find low-curiosity respondents willing to follow-up with the second phase of the research: each of the lowest five Interest and Deprivation scorers chose not to participate further. Since the purpose of the interview was to gather qualitative data from extremes on either the high or low ends of the scale, it was decided not to settle on middle-low responses and to consider the lack of response to be a statement itself.

The lowest respondent on the Need for Cognition Scale, however, was available and willing to be interviewed, as were the highest scorers on the Interest-type, Deprivation-type and Need for Cognition Scale. The respondents were two high school freshmen and two seniors, one female-identifying and three male-identifying, one mixed-race and the other three white, all middle class or higher.

Instruments

The Interest/Deprivation Scale (Litman, 2008) and the Need for Cognition Scale (Cacioppo & Petty, 1982) was administered to 76 gifted high school students and a smaller subgroup of non-gifted students from the same population. The NFC is either a 34- or 18-item assessment (5-point Likert response scale); for this investigation, the 18-item version was used because it was the scale used for the historical comparison, and

more statistical data exists for the 18-item versus the 34-item version (Benge, 2014; Cacioppo & Petty, 1984; Cacioppo et al., 1984).

The Interest/Deprivation Scale was developed from Litman and Spieberger's original 2003 Epistemic Curiosity Scale (ECS) and the Curiosity of Feelings-of-Deprivation Scale (CFDS) (Litman, 2008). It is a ten-item 4-point Likert rating scale which measures two types of curiosity: Interest-based (I-Type) and Deprivation-based (D-Type). I-Type curiosity is triggered by the positive reinforcement of learning new things as a pleasurable activity. Interest-based curiosity is defined by enjoyment in exploration (Litman, 2005; Litman, Hutchins & Russon, 2005), while Deprivation-based curiosity is defined by anxiety over things left ambiguous or unsolved (Litman, 2004). Litman calls this the wanting-liking model (2009) and is analogous to the relationship people may have with food: eating delicious food may be pleasurable (liking, I-Type), but hunger is an unpleasant motivator to eat (wanting, D-Type) (Litman 2005, 2008, 2010; Litman & Jimerson, 2004; Litman & Silvia 2006; Litman & Spielberger, 2003). The Interest/Deprivation Scale is useful not only for determining the relative degree of epistemic trait-based curiosity a subject has, but for more closely examining the motivation behind curious behavior.

The Interest-Deprivation Scale has positive correlations with other curiosity instruments and only nominal relationships with measures of other constructs (Litman & Jimerson, 2004; Litman & Silvia, 2006; Litman & Spielberger, 2003). The questions on the instrument were designed to reflect specifically on the pleasure and anxiety components of curiosity. For instance, a question like, "I enjoy learning about subjects

that are unfamiliar to me" is designed to measure the I-Type curiosity, while, "I can spend hours on a single problem because I just can't rest without knowing the answer" measures the anxiety-driven D-Type curiosity.

The interview component of the research project used the Gateway Approach (Mears, 2009) to semi-structured interviewing. The interview guide (Appendix B) served as a foundation for the process, which is designed to encourage the interviewees to give in-depth responses to open-ended questions. As prescribed by Mears (2009), each participant was interviewed twice (or three times if the first two interviews are particularly productive), with a chance to reflect on their previous responses between sessions. The interviews were conducted in a quiet room, perhaps at the participants' school, in order to get a clean audio recording and remove distractions. The goal of this element of information-gathering is not to answer specific questions, but rather to get a deeper understanding of the subjects' experience with curiosity as a concept and how they perceive it (Mears, 2009). The interviewer approached the interview as what Eisner (1998) calls a connoisseur of the subject matter, so that they might be able to craft questions during the interview which ask for this deeper exploration from the interviewee.

A question from the protocol such as, "Do you remember what it was like to be curious as a child? Can you give me an example?" is an example of an open-ended question designed to encourage the interviewee to tell a story that illustrates their experience, rather than simply answer succinctly. The goal is to provide a prompt for the interviewee and then allow them to generate a narrative without much guidance from the

interviewer. A question like, "What does it take for you to feel your curiosity about something has been resolved?" is more pointed, and is designed to get at the wanting-liking model of curiosity to determine the subject's feelings regarding whether a conclusion is necessary for satisfaction or if the process of gathering knowledge is more important.

Data Analysis

The key element of the quantitative analysis was to look for significance in the difference between curiosity in the students with and without a gifted identification. The null hypothesis was that the curiosity scores would be statistically comparable in the identified gifted population. If the null hypothesis could be abandoned, it might justify further study into potential use of curiosity psychometric instrument as an identification tool for students who may benefit from gifted programming but have not been identified as gifted through traditional means.

Split-half reliability tests (Cronbach's alpha calculated via SPSS) was applied to the responses from the NFC and I-Type curiosity and D-Type curiosity subscales from the I/D instrument; this provided an estimate of internal consistency. The I-Type curiosity and D-Type curiosity scales were also analyzed using Pearson's *r* to determine inter-test correlation. For data analysis, alpha was set at .05 (standard for some small social science studies) (Creswell, 2008) and t-tests were conducted to find the significance of the difference between curiosity, as measured by the Need for Cognition and Interest/Deprivation Scales separately, in the gifted and non-gifted students.

Scores from both quantitative measures were analyzed for differences based on sex of the participants, as well as status in a gifted program or not. Two-way ANOVA was conducted for the giftedness and gender factors in relation to the three curiosity measures: Interest-based, Deprivation-based and Need for Cognition.

If the quantitative analysis did not reveal the expected relationship, the qualitative data could still contain valuable information about curiosity theory as a whole (Creswell, 2010): the qualitative elements were broken down into themes and categories. Themes included "State and Trait-based Curiosity," "Positive and Negative Conceptions of Curiosity," "Interest-based Curiosity," "Deprivation-based Curiosity," "Open-ended Problems," "Understanding the Problem, Not Just Getting The Answer," and "School." The researcher looked for commonalities among respondents with high curiosity scores, as well as divergent responses between high and low curiosity participants.

Transcriptions of the interviews were in vivo coded for themes surrounding feelings of pleasure in exploration, anxiety around unresolved problems, and emergent categories related to expressions of curiosity. Data generated by the interviews was also used to verify the veracity of the quantitative strand: if there was a significant disconnect between the qualitative and quantitative elements, the instruments for data collection would have been flawed.

Limitations

The biggest concern in regard to limitations of this research are that the epistemic curiosity psychometric instruments are culturally biased, and would thus be a poor substitute for the traditional assessments used to identify gifted students. Although the

research seems to suggest that the Need for Cognition scale, at least, is relatively neutral across racial lines (Culhane et al., 2006), the Interest/Deprivation Scale has not had specific testing to look for cultural bias.

The Need for Cognition scale is not designed for adolescents, although it has been used with that demographic group in the past (Benge, 2014). There are some concerns that the wording of questions on the NFC might not be at adolescent reading level: Benge (2014) found that in the age range of 16-18 years, a mean of 16.67 questions out of 18 total (SD = 1.74) were at high school reading level and fully understood. It is possible that reading comprehension may influence the results of the study. For the purposes of full disclosure: the interviewer was prepared to answer clarifying questions about any of the 28 items on the instruments in this research study, which may have altered the response data, although that proved unnecessary.

Likewise, the Interest/Deprivation Scale may not be the ideal instrument for measuring Interest and Deprivation elements of curiosity in adolescents. An Interest/Deprivation Scale designed for adolescents specifically (the I/D-AC) is still in development at the time of this dissertation (Litman & Zettler, in development), so the adult version was used instead.

Another possible concern is that the subjects of the study, being adolescents, may not be completely forthcoming with their responses. They may try to paint a favorable picture of themselves at the cost of authenticity or may, on the other hand, attempt to sabotage the process with flippant answers due to lack of concern. This needs to be kept in mind for both strands of research.

Correlation does not imply causation: it has already been established that curiosity degrades over time at varying rates depending on educational experience (Engelhard and Monsaas, 1988), it is possible that exposure to gifted programing is responsible for the higher rates of curiosity in the gifted sample. If gifted education generates high curiosity rather than high curiosity adolescents being admitted to gifted programs, than its usefulness is limited. Further research is needed to untangle the relationship.

Researcher bias cannot be ruled out as a limitation of the study. The search for respondents may have been influenced at some point by the researcher, resulting in a corrupted quantitative sample. Additionally, it's possible that respondents may have been influenced to answer questions in one manner or another based on the circumstances in which they heard about the research. The entire qualitative data-gathering aspect may have been swayed by a line of questioning that guided respondents into answering in ways that the researcher supposed.

It was not be possible to gather data about the criteria for gifted identification used for all participants. Students from the two participating school districts had differing identification procedures, as did the respondents who were outside those two districts. The lack of a recognized standard for identification may mean that participants from the gifted sample could have had wildly different methods of entry into gifted programs. Neither of the two participating districts clearly outline their identification procedures on their websites or published materials, so the methods used to find gifted students remain largely mysterious and opaque. Unfortunately, this discrepancy between benchmarks for gifted identification is part of the problem that this research hopes to address.

The sample size of gifted students was less than the 110 that was initially proposed. The non-gifted sample was likewise on the small side, although the means for that sample were comparable with historical data on the Interest/Deprivation Scale, which made it more reasonable to draw generalized conclusions about the results when conducting analysis. This was due to the difficulty in finding research participants in general. It took several years before any school districts could be found willing to allow research to be conducted on their student population, and gifted students are a small minority within any given school.

The incongruence between the historical values of NFC and the data collected in this study provide another limitation. Although the results were extremely promising (with a high effect size), they were ultimately only a reflection of the comparison between a small (n=76) GT sample and an even smaller (n=36) non-GT sample. If the non-GT sample had been in alignment with the historical data the way the I-Type and D-Type measure were, the results would be more valuable. Until the results can be replicated with a larger non-GT sample, the results should be treated with caution.

It was almost impossible to collect data about what process was used to identify the gifted students in the study: most of the GT sample had only vague recollections of tests or interviews, so the identification process was generally conducted by school personnel who concealed the steps of the process from the students. The opaque nature of gifted identification meant that the majority of gifted-identified students and their parents had no idea what criteria were used to identify them.

Further difficulties arose when trying to collect qualitative data. The highest scorers on each of the three measurements were willing to participate, but the low-scoring students expressed little to no interest in following up with interviews. When the lowest scorers were unwilling to participate, the next one on the list was contacted. After going through 5 participants on each of the I and D-Type measures, the means of the next participant were not low enough to be noteworthy, thus betraying the original intent of the interview process.

In all cases, both GT and non-GT samples were composed of voluntary subjects, which may have affected the scores on the curiosity assessments; participation alone may indicate a higher-degree of curiosity, although participants were not told about the nature of the research before they agreed to it. The measurements used for this study also used self-reporting instruments, which are subjective by their nature, and could be affected by other factors such as non-gifted male respondents on average reporting higher values on the I-Type measure than their female peers.

The adolescent population was chosen due to the difficulty in securing younger participants, the availability of existing normed assessments and historical data. There is no reason to assume without further research that young children in the age range where gifted identification usually occurs will reflect the trends determined by this study. Finally, correlation does not imply causation: it is possible that enrollment in gifted programs increased the epistemic curiosity of the respondents with high levels of curiosity rather than being inherent to their personality. If gifted identification and

subsequent programming increases curiosity rather than is a reflection of it, than the value of this research becomes quite limited (although still interesting).

Chapter 4: Results and Findings

Purpose

The purpose of this study was to utilize instruments to measure curiosity as a potential identification tool for gifted education. Established instruments, the Interest/Deprivation Scale and Need for Cognition Scale, were administered to a sample of gifted adolescents and a sub-sample of non-gifted adolescents. The means of the samples of I-Type, D-Type, and NFC were compared to each other, as well as to historical data for the instruments used. A follow-up second phase involved interviewing the outliers from the quantitative study, as both an explanatory element and potential tool for triangulation.

Research Questions

Is epistemic curiosity positively related to giftedness?

How does epistemic curiosity manifest in gifted populations?

To what extent do the quantitative and qualitative data converge? How and why?

Results

This chapter provides results of the data generated–both quantitative and qualitative. In accordance with the third research question, results of the empirical data are summarized first. The internal consistency reliability of the scales is displayed initially, with each scale or sub-scale reported separately. A subsequent qualitative analysis of the lengthy interviews conducted follows. The null hypothesis is that Gifted respondents will have comparable scores on measures of curiosity to their non-Gifted peers, as well as to the historical reference data.

Reliability

Internal consistency reliability was estimated with Cronbach's alpha for each subscale (the I-Type and D-Type for the Interest/Deprivation Scale) and the NFC scale using a split-half test, revealing acceptable reliability for the NFC scale but reliability lower than desired for the subscales of the Interest/Deprivation Scale (Table 4). The subscales were only 5 questions each for the Interest/Deprivation Scale, with the 3rd item from each subscale used twice.

Table 4

Internal Consistency and Split-Half Reliability

I-Type			
Cronbach's Alpha	Part 1— I-Type items 1-5	Value	.72
		N of Items	3[a]
	Part 2— I-Type items 5-9	Value	.53
		N of Items	2[b]

	Total N of Items	5	
Correlation Between Forms	.61		
D-Type			
Cronbach's Alpha	Part 1— D-Type items 2-6	Value	.62
		N of Items	3[c]
	Part 2— D-Type items 6-10	Value	.67
		N of Items	2[d]
	Total N of Items	5	
Correlation Between Forms	.63		
NFC			
Cronbach's Alpha	Part 1— NFC Items 1-9	Value	.84
		N of Items	9[e]
	Part 2— NFC Items 10-18	Value	.76
		N of Items	9[f]
		Total N of Items	18
Correlation Between Forms	.70		

[a]The items are 1,3,5
[b]The items are 5,7, 9
[c]The items are 2, 4, 6
[d]The items are 6, 8, 10
[e]The items are 1, 2, 3, 4, 5, 6, 7, 8, 9
[f]The items are 10, 11, 12, 13, 14, 15, 16, 17, 18

Inter-test correlations are provided in Table 5. Spearman's rho determined inter-test correlation as significant at the 0.01 level (2-tailed).

Table 5

Inter-test Correlations

Correlations		I-Type	D-Type	NFC
Spearman's rho	I-Type Correlation Coefficient	1.00	.44***	.60**
	D-Type Correlation Coefficient	.44***	1.00	.47**
** p < .01 level (2-tailed) *n*=112 ****p* < .001				

Table 6 provides the means and standard deviations for the GT sample (n=76), the non-GT sample (n=36) and the historical data from Culhane el al. (2006) and Lauriola et al. (2015) used for comparison in this study.

Table 6

Descriptive Statistics for Scales

	Adolescent GT Sample	**Adolescent non-GT Sample**	**Historical (non-GT Data)**
n	36	76	274
I-Type Mean	16.27	14.36	14.35
I-Type Standard Deviation	2.7	3.30	3.04
Skewness	-.73[a]	-.39[b]	
Kurtosis	-.14[c]	-.79[d]	
D-Type Mean	11.93	11.06	11.14
D-Type Standard Deviation	3.25	3.13	3.05
Skewness	.12[a]	.40[b]	
Kurtosis	-.06[c]	-.66[d]	
NFC Mean	64.84	58.08	40.30
n	36	76	367
NFC Standard Deviation	8.88	11.10	9.35
Skewness	-.47[a]	-.25[b]	
Kurtosis	.20[c]	-.12[d]	
[a]Standard Error of Skewness = .28 [b]Standard Error of Skewness = .39 [c]Standard. Error of Kurtosis = .55 [d]Standard Error of Kurtosis = .77			

The I-Type mean of the Adolescent GT Sample is higher than the Adolescent non-GT Sample, which is extremely close to the mean from the Historical Sample. The D-Type means are all relatively similar, although the Adolescent GT Sample once again is the highest of the three means. Finally, the NFC means of both the Adolescent GT Sample and the Adolescent non-GT Sample are so markedly higher than the Historical mean that it is questionably valid.

Historical Comparison

T-tests conducted to assess mean differences between the Historical I/D data and the contemporary samples of students revealed nonsignificant results in the non-GT sample (n=36), with *p* values of .99 and .88, respectively, for the I and D scales (Table 7), but significant differences in the GT sample (n=76), with *p* values of <.01 for I-Type and .036 for D-Type (Table 8). Without access to the data set for the historical data, one-sample t-tests were used to compare the contemporary data and the published historical results.

Table 7

One-sample t-test between Non-GT and Historical Data Means

One-Sample Test: Historical Data		Test Value = 14.35		
	t	**df**	***p***	**Mean Difference**
I-Type	0.09	35	.99	.01
One-Sample Test: Historical Data		Test Value = 11.14		
	t	**df**	***p***	**Mean Difference**
D-Type	.015	35	.88	.08

Table 8

One-sample t-tests between GT and Historical Data Means

One-Sample Test: Historical Data		Test Value = 14.35		
	t	**df**	***p***	**Mean Difference**
I-Type	5.57	75	<.01	1.70
One-Sample Test:		Test Value = 11.14		

Historical Data				
	t	**df**	***p***	**Mean Difference**
D-Type	2.13	75	.036	.79

T-tests between the gifted and non-gifted samples revealed some significant differences. While the difference in D was not significant between GT and non-GT respondents ($p = .18$), there was a wide disparity in I values and NFC values, resulting in p values of <.01, below the threshold to be considered statistically significant, allowing rejection of the null hypothesis that gifted and non-gifted populations would be comparable on such an inventory. These results are shown in Table 9. The results indicate that Gifted adolescnets were on average notably more curious in the Interest-based (enjoyment-focused exploration) aspect of curiosity, while they had comparable Deprivation-based (anxiety-focused) mean scores.

Table 9

Independent Samples Test Between GT and non-GT Sample Data

Independent Samples Tests						**95% Confidence Interval of the Difference**	
	t	**df**	***p***	**Mean Difference**	**Std. Error Difference**	**Lower**	**Upper**
I-Type	-2.90	110	<.01	-1.69	.58	-2.85	-.536
D-Type	-1.35	110	.18	-.88	.65	-2.17	.41
NFC	-3.47	110	<.01	-6.76	.1.95	-10.62	-2.89

Analysis of the Need for Cognition scale also showed substantial differences between gifted and non-gifted populations ($p < 0.01$), but the comparison with the

historical data is not as clear. The difference in means between the contemporary Teenage non-GT sample was greater than the difference between the contemporary Teenage non-GT and Teenage GT samples. This implies that there may be a discrepancy between the Need for Cognition Scale given to the historical population in Culhane, Morera, and Watson's 2006 study and the one used for this research study. The means and standard deviations for the historical data and the data collected in this study are presented in Table 10.

Table 10

Historical Need for Cognition Data

NFC Scale	Mean	Standard Deviation
Historic (Hispanic)	41.85	9.03
Historic (Anglo)	40.30	9.35
Contemporary GT	64.84	8.88
Contemporary non-GT	58.08	11.10

If historical NFC data are disregarded and focus is instead on comparing the scores between the gifted and non-gifted teenage populations surveyed in this research study exclusively, results can be compared on an equal footing, albeit with a dramatically reduced sample size and accompanying confidence level. The disparity between the means and range of responses on the NFC scale between GT and and non-GT samples in this study was statistically significant ($p = .0018$).

I-Type Curiosity

Table 11 provides the mean, standard deviation, and sample size by group by gender for the I-Type Curiosity Subscale.

Table 11

I-Type Curiosity Descriptive Table

I-Type Curiosity	**Mean**	**Std. Deviation**	**N**
Gifted Girls	15.79	2.93	38
Gifted Boys	16.32	2.37	38
Non-Gifted Girls	12.89	2.85	19
Non-Gifted Boys	16.00	3.06	17
Historical Data	14.35	3.04	218

A two-way ANOVA was conducted that examined the effect of gender and giftedness on I-Type Curiosity. A test for homogeneity of variance revealed a *p* of .56 so homogeneity of variance could be assumed. Gifted and non-gifted boys reported significantly higher levels of I-Type curiosity than their female peers, although the difference was much less in the gifted population. Both main effects of Giftedness and Gender were significant, as well as the interaction between the two (Table 12). Figure 1 provides a display of the significant interaction.

Table 12

I-Type Two Way ANOVA

Tests Between Subjects Effects		Dependent Variable: I-Type Curiosity				
Source	Sum of	df	Mean	*F*	*p*	η^2

	Squares		Square			
Giftedness	62.817	1	62.817	8.250	.01	.071
Gender	80.374	1	80.374	10.556	.00	.089
Giftedness * Gender	40.533	1	40.533	5.323	.02	.047
Error	822.316	108	7.614			

Figure 1

Interaction Effect for I-Type Curiosity

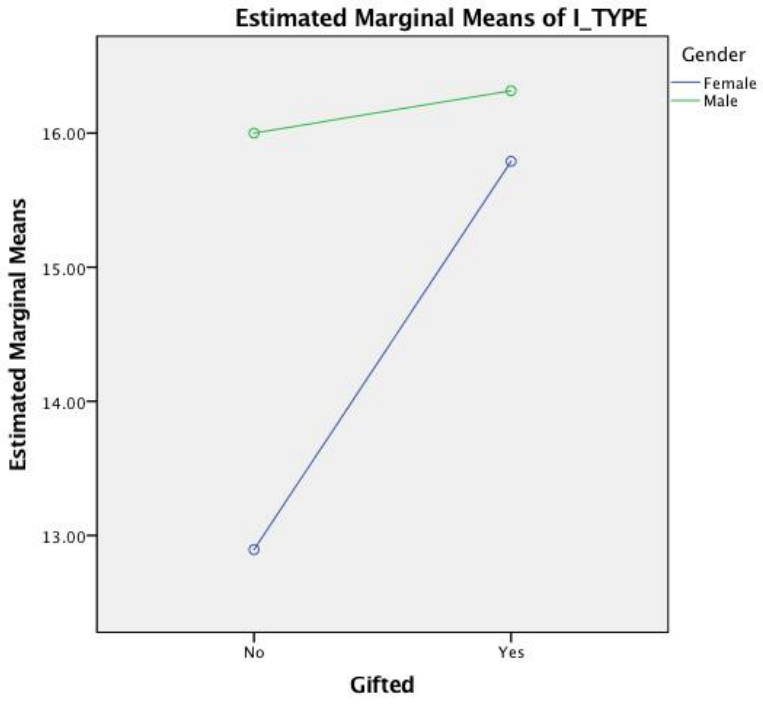


Figure 1 demonstrates the inconsistency in reported results when broken down by gender. Non-gifted girls were much less likely to report seeking, I-Type, curiosity

behaviors and attitudes than their male peers, although that discrepancy was much less noticeable when comparing gifted boys and girls.

D-Type Curiosity

Table 13 provides the mean, standard deviation, and sample size by group by gender for the D-Type Curiosity Subscale.

Table 13

D-Type Curiosity Descriptive Table

D-Type Curiosity	**Mean**	**Std. Deviation**	**N**
Gifted Girls	11.1316	3.04179	38
Gifted Boys	12.7368	3.29360	38
Non-Gifted Girls	10.9474	3.17059	19
Non-Gifted Boys	11.1765	3.18660	17
Historical Data	11.14	3.05	218

A two-way ANOVA was conducted that examined the effect of gender and giftedness on D-Type Curiosity and found no statistically significant interaction or main effects (Table 14). A test for homogeneity of variance had a *p* value of .90, so homogeneity of variance was assumed.

Table 14

D-Type Two-Way ANOVA

Tests Between Subjects Effects		Dependent Variable: D-Type Curiosity				
Source	Sum of Squares	df	Mean Square	F	p.	η^2
Giftedness	18.549	1	18.549	1.843	.18	.017
Gender	20.507	1	20.507	2.037	.16	.019

Giftedness * Gender	11.542	1	11.542	1.147	.29	.011
Error	1087.128	108	10.066			

Need for Cognition

Table 15 provides the mean, standard deviation, and sample size by group by gender for the Need for Cognition scale. A test of homogeneity of variance was conducted and revealed a *p* value of .69.

Table 15

Need for Cognition Descriptive Table

NFC	**Mean**	**Std. Deviation**	**N**
Gifted Girls	64.5789	8.08947	38
Gifted Boys	65.1053	9.70592	38
Non-Gifted Girls	59.2353	10.89074	17
Non-Gifted Boys	59.2353	11.55708	19
Historical Data	40.30	9.35	367

A two-way ANOVA was conducted that examined the effect of gender and giftedness on Need for Cognition (Table 16). The main effect of giftedness was significant, but the main effect of gender was not significant nor was the interaction.

Table 16

Need for Cognition Two-Way ANOVA

Tests Between Subjects Effects	Dependent Variable: NFC			

Source	Sum of Squares	df	Mean Square	F	p	η^2
Giftedness	1093.693	1	1093.693	11.604	<.01	.097
Gender	44.724	1	44.724	.475	.49	.004
Giftedness * Gender	16.720	1	16.720	.177	.67	.002
Error	10178.848	108	94.249			

Findings

After initial quantitative data collection, means were calculated for each participant in the sample and the highest and lowest of each of the I-Type, D-Type, and NFC categories were contacted to conduct follow-up interviews. This is a variation from the proposed method of gathering the highest, lowest, and median I-Type and D-Type responses. When the quantitative research revealed significant differences in the means of both I-Type and NFC scales but comparable levels in D-Type, it was decided that there would be more value in interviewing all outliers than the median-scoring respondents.

Throughout this analysis, the respondents will be referred to by the qualifiers, "High-I," "High-D," "High-NFC" and "Low-NFC." Because a respondent could score high (or low) in more than one area, the interviews do not provide a pure, unadulterated account of the manifestation of that particular measure, but they do provide insight.

The Gateway Model of interviewing has an analysis process wherein the interview is compressed and distilled into a summary that vaguely resembles poetry

(Mears, 2009). This allows a lengthy narrative to be broken down into a concise format and the most important details to come forward. For each of the interviewees, Gateway analysis has been presented, followed by a more traditional presentation of qualitative findings.

High-I

I'm curious.

Sometimes more than other times.

Curiosity is asking questions that no one else has.

Or adding on to questions.

Any questions.

I like asking questions.

Why do mammals not lay eggs?

Any questions.

Should I have yogurt or applesauce?

It's mostly intellectual, not instinctual: Curiosity tends to lead to thinking.

Some people are more curious than others.

It can be developed, just by asking questions.

It's like a skill.

Interest helps.

Is it intriguing?

Science is intriguing.

Technology is intriguing.

Because learning new things feels good.

It excites me.

And I'd miss it if it were gone.

(It'd be boring)

Curiosity doesn't leave me hanging often: it's only good feelings

How did they get the toothpaste in the tube? Google that!

Curiosity is never a problem, at least not for me.

(Or my friends: they are curious too)

But it's not always useful either.

I'm lucky that school is usually interesting to me.

Does school align with my interests or do my interests come from the school?

School hopes to trigger curiosity, but it doesn't always work, and certainly not for everyone.

Curiosity makes learning easier.

Even chocolate-covered broccoli is okay with me.

High-D

I'm curious.

I'm interested in medicine.

And car accidents.

And criminal forensics.

I want to follow the ambulance.

That's MY curiosity.

If I'm not looking at you, it's not because I'm not listening,

I just want to know everything else that's going on too.

I'm curious about stuff but if I'm not interested in it I'm just going to let it go.

If it doesn't appeal to me, I'm not going to care.

I'm just nosey.

When I'm curious and interested, I won't let it go until I figure it out.

Car accidents: I can spend literally hours looking them up to see if I can find any information.

When I'm curious about something, I'll follow it up.

Until I know EVERYTHING that there is to know and I just can't find any more.

It's always in the background.

I'm curious about it to a point.

Like, until it goes away.

Until I can find out as much as I can.

There's not much more I can do after that.

One time I saw an ice cream truck on fire on the highway.

Definitely needed to follow up on that one.

I'm a pretty busy person.

Did you hear about the Italian scientist who is going to try a head transplant?

I've gone down the rabbit hole.

If curiosity has a downside, it doesn't apply to me.

In the end, I'm going to figure it out.

Boredom is when school doesn't line up right.

Like, doing English in Chemistry, or English in some other class.

Open-ended questions are good educational practice… but, grrr.

Give me a problem I can actually solve any day.

Give me the tools to the problem and let me go to town. No hand-holding.

High-NFC

I'm curious.

Curiosity is a desire to create.

To find new things and new solutions to existing problems.

It drives any sort of innovation or creation.

It's a necessary part of human behavior.

It's a spectrum.

Even when you are exhausted, there's still that spark.

But you can cultivate it by exploring ideas and new ways of thinking.

You can memorize without curiosity.

But without curiosity there is no application of ideas

There's no drive to use the ideas to find more ideas.

Curiosity always leads to more curiosity. It begets itself.

I started playing with polyrhythms and having maybe one ostinato

Five notes over six notes, played until they line back up.

What about six over seven?

Or five over seven?

And that led to Charles Ives, detuned pianos and “musical saw.”

Man, I used to love Legos.

Making little puzzle boxes.

You can maintain "childish" curiosity into adulthood.

At least, I've gotten that far.

Fascination and joy.

Passion.

But curiosity can be overwhelming.

Risk-taking is essential.

Are we talking about curiosity or creativity? Is there a difference?

All morning I've been trying to figure out something.

I didn't get to it this morning and I'm totally still thinking about it.

This SIMPLE THING THAT DOESN'T IMPACT MY LIFE IN ANY WAY.

When curiosity ends, my family calls it "post-partum."

The let down of not having curiosity anymore.

Withdrawl.

But it’s worth it. Curiosity is a net good.

Low-NFC

Custom game or active server?

Arcade mode.

XP towards leveling up.

Loot box.

Legendary item.

When it doesn't turn out, it's aim-bot hackers or jittermod hackers.

But it's Quickplay, which is why I don't go there.

When I was a child, I didn't even know about Overwatch.

When Doomfist came out, I was excited.

I only play Competitive Games and Custom Games.

3 vs. 3, 1 vs. 1, 6 vs. 6.

Never Quickplay.

I can't solve the puzzles in games.

I look up the answers.

Headshot. One-hit kill. Boom. Get wrecked.

I got good when I was around level 90.

But I'm going to get to level 101.

I can learn video games quickly

School stuff is boring: I'm not going to be a scientist.

Curiosity is a state of mind.

Curiosity is something you think about, but would never do.

Could I jump in a dumpster?

I feel like I'm in limbo all the time.

Some people aren't doing anything with their lives.

Emerging Themes

The transcripts were *in vivo* coded and then compared for thematic consistency. Excerpts from the interviews are used to establish themes and help provide context to the empirical data generated by the study.

State and Trait-based Curiosity

One of the principle debates in the academic world surrounding conceptions of curiosity is whether curiosity is a trait, a state, or both. All three of the high-scoring respondents agreed that curiosity was more of a trait than a state, although they also stopped short of calling it a fixed trait with genetic origins. High-I said, "Some people might be [innately more curious], depending on what environment they are raised in. And it can be developed just by asking questions. You can become more and more curious about things. It's like a skill."

High-D drives the point further: "Not to be all sciencey, but probably some of it is genetic. Just like how smart you are, some of it's genetic and some of it you obviously develop better habits than others. But I think that everyone has a degree of curiosity and it's just a matter of how much they care about building off that. Do they WANT to become more curious? And if they don't then they're just going to be more closed minded…I think that it can definitely be developed, but I do think that genetics probably plays a role in it and the environment plays a role in it."

High-NFC, on the other hand, is willing to entertain the idea that it might be both a state and a trait. "Perhaps rather than "state," I would say "spectrum?" I think it's always there, even when you are exhausted or coming from a big day of minutiae. It's

still possible to have that spark. So I think that rather than being an innate trait in everyone equally, it's possible to cultivate curiosity through exploration of ideas and exploration of new ways of thinking and concepts."

Presenting a counterpoint, when presented with a similar line of inquiry, Low-NFC said, "I think that curiosity is probably a state of mind, because I know a lot of people who are really, like, reserved and they still do a lot of funny things." Low-NFC's statements implies that he finds curiosity linked with extroversion, and curious acts as being somewhat abnormal. He then described an acquaintance who was socially awkward and withdrawn, but who was still able to enjoy video games when approached by someone else.

Positive and Negative Conceptions of Curiosity

Part of the differing opinions about trait vs. state-based curiosity may be due to inherently different conceptions of curiosity itself. All four respondents were asked to describe curiosity as a broad concept. Some responses were similar: "I think curiosity is asking questions that no one else has, or where people haven't added to those questions, (High-I)" and "Curiosity is the desire to create and to find new things and new solutions to existing problems (High-NFC)." But those are contrasted with Low-NFC's response: "Curiosity is something that you are interested in and something that you might never do… curiosity is something you know you'd never do, but you're still, like, interested in."

This is a fairly divergent conception of curiosity, and has negative connotations that the other respondents didn't have. While the high respondents talked at length about

their areas of passion and interest (High-I loves technology, High-NFC loves music, and High-D loves forensic investigation) as if they were inherently linked with curiosity, Low-NFC defined curiosity in terms of "forbidden fruit:" " I think, 'Hey, what if I jump into the dumpster?' Because, we have one of these giant dumpsters at our school. And I was like, 'Hmm, how could I jump into one of those and then get out safely?'" Low-NFC spoke about items of curiosity almost exclusively in terms of forbidden or verboten thoughts, except when describing the functions of his favorite video game.

When prompted to talk about the rewards of curiosity, Low-NFC described extrinsic rewards in terms of literal "in game" items provided as a prize for good play, while High-NFC passionately described the recent discovery of avant-garde composer Charles Ives through personal experimentation with polyrhythmic meter in a musical composition class using words like, "fascination and joy." High-I describes the experience of discovery as "exciting" and acknowledges the role neurochemistry has in triggering the pleasure centers of the brain when exploration occurs. For Low-NFC, however, it comes down to an outside force awarding a virtual gift for performing a task.

Unlike Low-NFC, who seems to view curiosity as something outside oneself, all three of the high respondents described it as inherent to their character, and in generally positive terms. When asked explicitly to describe any downside to curiosity, they were able to provide hypothetical examples, but none which pertained to themselves. High-NFC describes curiosity's dark side when, "..impacting relationships with people or your own health... I guess that's when it crosses over into being nosey; when you're not taking care of yourself because you're so focused on learning new things. I think, throughout

this whole discussion, curiosity and creativity have become very intertwined in my mind. So thinking of my mom: when she gets really into a painting that she's doing, she'll forget to eat lunch and forget to eat dinner and then wake up the next morning and start painting and forget to eat breakfast. And just get really inspired to be creating. And it's good to have space from that as well to make sure that you are taking care of yourself in other ways. I do think that being creative/being curious is as important as eating and sleeping; you know, it's sustaining your mental state, but it can't be at the risk of other things."

When asked if there was a negative element to curiosity, High-D was even more direct: "Um. I mean... not for me, because I'm not like this (it's just not something I would do), but I guess to an extent if someone were curious and getting into government files or something and being hacker-like or stalker-like or something. I guess at that point you know too much information and you could get hurt, someone else could get hurt, something could leak... at that point, yes, curiosity does have a downside, but for me personally, I'm not going to hack some computer."

I-Type

I-Type curiosity is the element that finds pleasure in questing, seeking and discovery. Through the interviews it became clear that this is not a universal trait, but one that is tempered with personal interest. High-D expressed a strong interest in criminal investigation and forensic sciences, with a particularly niche fascination with traffic accidents, but began the interview by putting down political science as a discipline and expressing a distinct lack of interest in geology. Similarly, High-I described how a love of states of matter like plasma and Bose-Einstein Condensates had led to a deep

appreciation for technology and a current fascination in particular with computer hardware. High-NFC lovingly described how a childhood preoccupation with assembling puzzle boxes out of Lego blocks led to an all-night session trying to build complex circuits in the virtual world of Minecraft. Even the low NFC respondent had an area of passion: he was able to turn almost every single question in the interview into a chance to speak about the video game Overwatch.

The high respondents all seemed to present the premise that curiosity is separate from, and requires, interest in a topic. They all described, un-promoted, specific epistemic concepts that held personal interest for them, addressing the two axes that Berlyne described in his theory of curiosity (1954a, 1962, 1978): specific versus diversive and epistemic versus perceptual.

The origins of interest seem difficult to predict. High-I describes randomly wondering about how a tube of toothpaste is filled: interest begets curiosity, which leads in that particular case to Googling about toothpaste production. High-D describes so many interests that it is necessary to perform "triage" and let some of them go, because, "I'm not going to find out *everything* because I just don't have that much time to look at stuff." While the others explained the necessity of interest in curiosity, Low-NFC demonstrated it by steadfastly resisting talking about anything other than his area of interest with the video game Overwatch for the majority of our interview.

The highly curious described the branching nature of inquiry: how investigating one thing can trigger interest and subsequent curiosity in another subject entirely. "Without curiosity, there is no application of ideas and there's no drive to use the ideas to

find more ideas," said High-NFC. High-D laughed and heartily agreed when asked if there had ever been a "rabbit hole" moment where a Wikipedia search had led to a tangent into a totally new topic. This kind of self-perpetuation seems to be a hallmark of conceptions of curiosity by the highest respondents, and it was viewed in an overwhelmingly positive light.

Perhaps more disturbing was the language High-NFC used to describe the let-down after reaching what he referred to as "peak curiosity." In regards to the fallout after High-NFC's first performance with All-State Orchestra, "…my family calls it 'post-partum.'… I sort of went sort of like cold turkey right after this huge inspiring event and I didn't have anything else that I was looking forward to after that. I went into this really deep depression." When asked to elaborate on the feelings, High-NFC described what can only be described as withdrawal symptoms, implying that the neurochemical rewards for discovery (I-Type) can almost be viewed as addictive.

D-Type

D-Type curiosity is concerned with resolution of curiosity. All three of the high curiosity respondents described, to some degree, an anxious state that accompanies unsolved problems. Although they all initially downplayed how impactful this feeling was, the language used implies a significant disruption in emotional wellbeing until either resolution or distraction can be achieved. For instance, when asked, "Would it bug you?" High-I responded with, "A little, yeah." When asked, "For how long?" he responded with an emphatic, "Until I solve it." The interviewer was than able to clarify, "So it would *really* bug you?" High-I responded with a grudging, "Yeah."

High-I described the situation: “I’m never, like, anxious, or… it doesn’t, like, mess up my whole day. It just annoys me. It keeps bugging me whenever I walk past it and it’s just sitting there unsolved.” During our interview, High-NFC was actually in the midst of processing an unsolved problem: “I didn’t get to it this morning and I’m totally still thinking about it. And I can’t let it go. Trying to design…this simple thing that doesn’t impact my life in any other way!” Low-NFC, on the other hand, expressed no sense of anxiety or tension about problems left unsolved, and described how he would simply look up the answers to puzzles in games on the internet rather than try to solve them himself.

While this might point to intensity as a defining factor of the manifestation of giftedness, with High-NFC and High-D describing lingering thoughts of unresolved problems haunting them throughout the day, it should be mentioned that Low-I was intensely passionate about his love of the videogame Overwatch, to the point that he disregarded most of the interview prompts to speak to that particular subject. In fact, it could be argued that Low-I manifested a specific interest, albeit a non-epistemic one, to the complete exclusion of diversive curiosity (Berlyne, 1954a, 1962, 1978). Intensity is often cited as a feature of giftedness, in the same way that conventional wisdom describes gifted children as being curious, but the Interest/Deprivation Scale and Need for Cognition Scale measure the intensity of epistemic curiosity, rather than the intensity of interest in a given subject. It is absolutely possible, as Low-I proves, to be fixated on a subject without having any particularly noteworthy innate curiosity questing, resolution-seeking, or enjoyment traits.

Perhaps unsurprisingly, High-D spent the most time talking about trying to resolve curious impulses. “Once I’m curious about something, I’ll follow it up until I know *everything* that there is abut it and I just can’t find any more.” When asked at what point an inquiry could be dropped, High-D said, “once I figure it all out… or if it’s evident that I’m not going to find out more, then I’m just going to have to let if go. Because I’ve got more interesting things to put my time into. Those are, like, side things. I have to focus on school, sports, clubs, friends.” It is inferred by the interviewer that a distraction makes it easier to drop a line of inquiry, but that it is always painful to some extent.

Deprivation-based curiosity is product, rather than process, focused. It is concerned with resolution and conclusion, while Interest-based curiosity is expansive and concerned with exploration (Litman 2005, 2008, 2010; Litman et al., 2010, Lauriola et al., 2015). Leaving a problem left unsolved is D-Type curiosity unresolved, and the only thing that might mitigate the frustration that someone with a high D-Type curiosity might feel is a similarly high I-Type curiosity to accompany it.

Open-ended Problems

The interview with High-D took an interesting turn when the discussion changed towards ambiguity and problem-solving. Although High-D described open-ended problems as a best practice for schools wishing to encourage and cultivate curiosity, it was apparent that High-D much prefers problems that have actual solutions, presumably so that there can be that sense of resolution that is so key to having a high D-Type curiosity.

"I mean, it's frustrating, obviously, because I like to be able to solve everything. But I feel like, for math especially, everything is solvable (even the unsolvable answers). For example: you can't divide by zero; I know that's unsolvable, but that's still a solved problem, technically. In the end, I'm going to figure it out. Even if I have to ask my teacher, or look it up, or... I realize it's like... for math, a few years ago we had to do, I think they're called the 'millenial problems?' There are like 10 problems, yeah? I mean, I'm not going to solve it, but, like, NO ONE solved it. That's why it's a millenial problem. I had to do a project on it, I had to understand it, and to that point it's like, 'I'm not going to do any more.' So I guess it's MOSTLY frustrating, when I know I know the math, or like the tools to get to a problem and I can't figure out how to apply them. But in the end I'm going to learn how to. I mean, that's what we have other resources for."

High-D doesn't necessarily need to solve the problem, but she needs to know that there is a solution. Problems without solutions that could eventually be uncovered are frustrating to High-D, even as she recognizes their value in education.

Understanding the Problem, Not Just Getting the Answer

High-D explained that she saw a gap in schools that she states isn't between those who are good at a subject and those who aren't, but rather those who have the curiosity to try to fundamentally understand the problem rather than simply try to solve it through formulas, rotes, and techniques they may have been taught.

"If I'm not going to automatically understand something, I like to work backwards. So get the problem, get the answer, figure out how to solve it in between. Like, understand the problem itself. But for some people it's easier, teachers are like,

‘here's step by step: memorize it’ because then it's just a formula. You do this first, then this, then this. But even though that may help people, I think they have to work harder in the long run to figure out how it all works together. Because not everything's going to be laid out like that.”

High-D continues, “I think that if you understand something, the test comes easy; when you have to memorize something, that's when it's hard because you're not understanding it. But when you understand it, it's like you can just derive from an equation or understand the root of this word or that word.” This implies that for High-D in particular, the tension comes not just from a failure to reach a solution, but from an inability to fully comprehend the problem as well.

This is particularly interesting coming from a respondent with the highest Deprivation-based curiosity score. D-Type curiosity, as defined by Litman (2005, 2008, 2010), is concerned largely with finding a solution to a problem rather than exploring a subject for the sake of discovery. In this case, however, the culmination of a curiosity impulse is understanding the nature of the problem rather than getting the answer. In school, High-D implies, everyone gets the answer eventually, but the same cannot be said for the totality of the question itself. This ties to the Need for Cognition as well: High-D implies that most students are content to apply the formula to a problem without really understanding either due to a lack of enjoyment in the act of cognition itself. Using a tool provided to solve pre-approved problems is no different from using a machine like a car or a computer without understanding the functioning behind it; it requires curiosity to

want to know why it works (Berlyne, 1966; Cacioppo & Petty, 1984; Cacioppo et al., 1996).

School and Education

The three high curiosity respondents all had positive feelings about their personal roles in formalized education. “I’m not really sure if the school really aligns with my interests or my interests come from school,” said High-I. On the other hand, school was not above critique as well. High-NFC said, “I think schools as an institution are poorly equipped to deal with curiosity, because curiosity requires a lot of independence and free reign and a lot of sort of supervision to make sure that you don't go too far and start hurting other people by getting into their business. I think of kids playing with blocks: if you give a bunch of kids a bunch of blocks and they start putting things together and one kid thinks, ‘what if I make a castle out of all the blue blocks?’ but other kids are using those blue blocks and they start stealing them then that's an example where it needs supervision. But I think for the most part, curiosity takes this really specific balance of independence and supervision and with schools and particularly with the inflation of class sizes, teachers are very poorly equipped.”

High-D paradoxically calls for more open-ended questions, when ambiguous questions and a lack of definitive answers are clearly disconcerting. “I think more open-ended questions would probably encourage people to think more. For me, though, I like questions where this proves this and this proves that. And it's concrete. So I like the open-ended questions, but I like the fact that there's probably some way to solve them. So, like, math again for example: no, someone may not have figured out Fermat's Last Theorem or

something like that, but in the end there's either not going to be an answer or there's tools and we just have to figure out how to apply them properly."

How Does Epistemic Curiosity Manifest in Gifted Populations?

Since the highest responses to the three survey measures were all in the gifted population, no qualitative research was done to interview highly-curious non-gifted teenagers. A comparison cannot be made about how highly curious gifted teenagers may differ from highly curious non-gifted teenagers, and perhaps that deserves a follow-up study. With the data gathered through interviews with the three most empirically curious individuals in the study sample who were also all identified as gifted, a profile can be generated of how curiosity manifests in the case of at least three specific gifted individuals. Those behaviors reinforced the theoretical lens of Interest and Deprivation-based curiosity. In particular, the highest I-Type respondent, High-I, described exactly the sort of intrinsic neurological reward for exploration that Litman outlines in multiple papers. The D-Type curiosity was well illustrated by High-D's inability to let things go without first depleting all avenues of inquiry, but also adds nuance to the conception of curiosity resolution by addressing the issues that might be present in using relatively ambiguous open-ended problems in a problem-based-learning context. With Need for Cognition being a sort of "catch-all," miscellaneous curiosity type, the "character" of different aspects of curiosity highlighted throughout the course of the interviews.

To What Extent do the Data Converge?

These qualitative data are in alignment with the quantitative data: the high respondents reported exactly the kinds of perceptions, behaviors and concerns that the

Litman's I/D paradigm implies (Litman, 2005; 2008; 2010). The low curiosity respondent, likewise, demonstrates a complete absence of the concerns that the other interviewees have about the very nature of curiosity. While he has *interest*, in his case, a very specific video game, he doesn't report any sort of intrinsic personal reward for pursuing inquiry (I-Type), nor a particular concern when problems are left unsolved (D-Type). While he is a fair student, he doesn't express any drive, whether positive or negative, to advance his understanding outside the realm of the Overwatch game. Nor does he express any particular joy in advancing his knowledge or metacognitive perception (NFC).

While the high scoring respondents expressed in detail the multitude of emotional states surrounding discovery, exploration, closure, resolution, and even obsession and addiction, these rich descriptions were completely absent in the low respondent. He simply didn't have the context to even approach the questions, so instead he discussed his favorite video game.

Summary

The purpose of this study was to investigate measures of epistemic curiosity (Berlyne, 1954) and their various manifestations with the ultimate goal of developing a screening tool to help identify underrepresented gifted students.

To that end, empirical measures were applied with 36 non-gifted and 76 gifted teenagers, as well as a pool of historical data from Culhane et al. (2006) and Lauriola et al. (2015) for both the scales utilized. The goal was to find a difference between means on these measures between gifted and talented 9^{th}-12^{th} grade gifted student populations

and their non-gifted peers. T-tests were conducted between GT and non-GT sub-samples, between both our sub-samples and the historical means, and two-way ANOVAs were conducted with the contemporary data to determine if gender was a mitigating factor in the results.

The first research question was whether high epistemic curiosity was positively related to giftedness. For some types of curiosity, that seems to be the case: the mean of the GT sample was higher than both the non-GT sample and the historical baseline at a statistically significant level in the I-Type sub-scale, as was gender (with a higher mean for boys than girls). There was an effect size of .07 for giftedness as a factor (medium effect), .09 for gender as a factor, and .05 for the interaction of factors. There were no statistically significant effects on the D-Type scale. The degree of disparity between historical and contemporary scores on the Need for Cognition Scale suggests that historical data should be ignored in favor of comparing "apples and apples;" there was a significant effect when comparing the GT and non-GT samples, with a .10 effect size.

By the measures used, the null hypothesis that there is no relationship between epistemic curiosity and gifted populations was rejected. The evidence supports the assertion that there is a connection, with higher scores for I-Type curiosity and Need for Cognition for gifted students but no difference found for D-Type curiosity.

The second research question asks how epistemic curiosity manifested in gifted populations. Interviewees for the qualitative component of the research were selected due to their extremely high or low scores on the quantitative measures provided, and all three high respondents were identified gifted. Themes uncovered in the high-curiosity sample

included debate over whether curiosity is a trait or a state, positive vs. negative conceptions of curiosity, the "rabbit hole" effect, curiosity withdrawal, ambiguity in problem-based learning, and views on school and education. The low respondent showed a lack of interest in the questions asked, and instead spoke about his favorite video game for the majority of his interview.

Interviewees responded as their quantitative scores would predict: respondents who had scored highly on one curiosity measure or another demonstrated high levels of curiosity in the interviews conducted, and the interviewee who scored extremely low on one of the measures also expressed little broad interest and did not demonstrate any of the behaviors that marked either Interest-based or Deprivation-based curiosity.

The third research question asked to what extent quantitative and qualitative data converged, as well as how and why. Between the quantitative and qualitative data, a clear picture formed of both the degree of curiosity in participants, but also the manifestation of that curiosity. Mixed methodology allows for deeper and richer data than would have been generated if one method or the other had been utilized (Creswell, 2010).

Chapter 5: Discussion

Restatement of Purpose

The purpose of this study was to explore the psychometric characteristics of measures of epistemic curiosity (Berlyne, 1954) as a potential identification tool for gifted education, particularly to serve students of color and low socio-economic status. Adolescents identified as gifted and talented (*n*=76) were given established quantitative instruments for curiosity and interviewed to generate qualitative data regarding curiosity, as were their non-gifted peers (*n*=36). The goal was to find a difference between means on a measure of the trait of curiosity (as measured by current non-cognitive psychometric instruments) and identification as gifted and talented in 9^{th}-12^{th} grade gifted student populations. Interviews were conducted with the highest scorers on the three measures of curiosity from the quantitative strand and one of the lowest scorers as well, both as an explanatory element and as a potential tool for triangulation. The interviews were used for explanatory purposes and to attempt to identify bias with the quantitative instrument. The strands were mixed in the analysis phase with the explicit transformative purpose of determining whether psychometric screens for curiosity hold any potential as a tool for identifying gifted students who may have been missed by traditional methods of GT (gifted and talented) identification.

Research Questions

Is epistemic curiosity positively related to giftedness?

How does epistemic curiosity manifest in gifted populations?

To what extent do the quantitative and qualitative data converge? How and why?

Summary of Results

Using instruments to measure Litman's Interest and Deprivation type curiosity from his wanting-liking model (Litman, 2005, 2008, 2010), as well as the Need for Cognition scale to determine overall self-reported joy while performing intellectual tasks, significant differences were demonstrated between the means of the gifted and talented and non-gifted samples, as well as with historical values. While the means of Deprivation-based curiosity ("D-Type") were comparable between the gifted and non-gifted samples, Interest-based curiosity ("I-Type") was significantly higher in the means of the gifted population than the non-gifted one. Analysis for Eta^2 (η^2) showed a medium effect size. While the differences between the historical values of the Need for Cognition Scale and both the gifted and non-gifted samples make it impossible to use the comparison between the current study and the historical one to make any sort of meaningful analysis, the difference between the gifted and non-gifted samples also showed significant differences with the historical sample, with a medium-high effect size.

There was a clear statistically significant difference between gifted and non-gifted populations on both the I-Type and NFC measures. The nature of this difference is open to interpretation, and the qualitative research methodology examines the manifestations

of these measures. Interviews with the highest scorers on I-Type, D-Type and NFC revealed certain themes among the profoundly curious: a belief in the innate (although flexible) nature of curiosity, an overwhelmingly positive conception of curiosity as a psychological construct, a conception that curiosity also requires a nebulous concept of "interest" which is illusive and personal, that curiosity can be self-perpetuating. The interviews also demonstrated distinct differences in preferred problem-based learning methods and the degree to which curiosity must be "sated."

Based on both the results of the quantitative and qualitative research, it can be stated that high curiosity is a trait common to gifted adolescents. This is an assertion that has been repeatedly made regarding the gifted population without empirical backing (Clark, 2008; Colangelo, 2003; Ford & Harris, 1999), but the quantitative research of this study establishes the legitimacy of this claim to some degree. A further question is undoubtedly, "how *much* more curious are gifted adolescents than non-gifted adolescents?" A medium effect size indicates that the trend is noticeable if looking at data, but not necessarily obviously apparent to the untrained observer.

Gender was also a factor in the analysis of I-Type curiosity. Both gifted and non-gifted boys self-reported a higher level of I-Type, and the difference between gifted and non-gifted boys was much less pronounced (although still statistically significant) than the difference between gifted and non-gifted girls.

The qualitative research and analysis provides insight into what high curiosity "looks like" in a gifted population, because gifted students were uniformly the highest scorers on all three inventories. There were variations based on the differences in

curiosity type, but the similarities between the high curiosity scorers stood in stark contrast to the low curiosity interview.

While further research must be conducted to address the limitations of this study, this data can inform future literature about gifted students to affirm empirically that high curiosity is indeed a common trait of that population. Furthermore, assuming that subsequent research reveals that these traits are common across different ethnic and cultural demographics, an instrument could absolutely be developed to screen for high curiosity and "flag" a student for further investigation into potential gifted identification, or even serve as a component of a gifted identification "body of evidence" based on the Need for Cognition Scale or some measure of Litman's Interest-type curiosity (2005, 2008, 2010). Engelhard and Monsaas (1988) demonstrated that curiosity as a trait may decrease over time, either due to naturally-occurring maturation or as the result of exposure to traditional school environments, so a similar test, properly normed, should have something substantive to measure in younger populations as well.

Litman has been developing an Interest/Deprivation instrument for younger respondents, based on parent reporting rather than self-reporting. Some districts, including one of the two that agreed to host this research project, already utilize parent observation instruments as part of the multi-faceted "body of evidence" files, which opens possibilities for the inclusion of curiosity-based parental assessment in the process.

There is ample reason to continue research into curiosity as a measurement tool that could be utilized for gifted identification, and at this point there is no data to suggest that it could not be used to increase involvement of students of color, students of low

socio-economic status, or even students with disabilities or other factors that might mask traditional gifted identification who are sometimes referred to as "twice exceptional."

Conclusions

As a result of this study, the data indicates that gifted adolescents exhibit, on average, more seeking/exploratory curiosity than non-gifted adolescents. Moreover, they are significantly more likely to report joy in intellectual and cognitive tasks than their non-gifted peers. High curiosity, as exhibited by gifted students, may be consuming, to the point of perhaps appearing obsessive to those who don't experience similar behaviors.

Intense manifestations of character traits called "overexcitabilities" have been frequently cited in gifted literature, based on the work of Polish psychiatrist, psychologist and theorist Kazimierz Dabrowski and his theory of moral development known as "positive disintegration," who noted in an appendix of one of his works that gifted students showed a higher preponderance of the traits necessary for resolving the kind of emotional and cognitive dissonance to advance along his hierarchy of moral development, although he himself didn't do any research on gifted children. These overexcitabilies are beneficial for resolving the kinds of personal paradoxes that Dabrowski found compulsory for moral growth, but since his death in 1980, his work has also been embraced by advocates of gifted education as being indicative of giftedness as a whole (Hafenstein & Tucker, 1997; Falk, Lind, Miller, Piechowski & Silverman, 1999; Falk, Piechowski & Piirto, 2000; Mendaglio & Tillier, 2006).

The intensity of curiosity that the high levels of the Interest/Deprivation Scale and Need for Cognition Scale imply are perhaps mirrored in the manifestations of

Psychomotor, Sensual, Imaginational, Intellectual, and Emotional states that may be exaggerated for gifted children. If gifted students are, indeed, prone to a heightened level of intensity in any of these areas, it would not be particularly surprising if their manifestations of curiosity were likewise amplified.

Cognitive Traits Separate From Conceptions Of Intelligence

The academic arguments surrounding intelligence such as a single *g* trait and other unidimensional conceptions such as Terman's model, Thurstone's seven-fold Primary Mental Abilities model, or Guilford's multi-faceted theory, have led to countless psychometric instruments for measuring intellect, but these tools may be biased along cultural, economical, or class lines. In an attempt to identify intelligent children who require additional advanced educational programming, these cognitive tests may be excluding a large portion of specifically African-American and Hispanic students, as well as students in poverty and students with conditions that may mask their gifts, such as ADHD, learning disabilities or Autism Spectrum Disorders.

Certainly, gifted and talented programs since the establishment of the National Association for Gifted Children have been dominated by white and upper-middle class students, largely due to the criteria by which students were identified (Ford & Harris, 1999). Due to biased identification methods, students of color are missing from gifted programs at a truly astonishing rate: while Black students who represent 16% of the school population, they constitute only 8% of gifted programs, but are a full 30% of students expelled. They are twice as likely to be referred for special education as gifted programming, completely out of sync with their white peers. Assuming an equal

distribution of giftedness –and there is no reason not to other than racism- there are a missing 500,000 Black and Hispanic gifted students who have not been identified by current methods (Ford, 2010).

This study proposes another way: what if desire to learn was a factor in identification rather than -or in addition to- the poorly defined conception of "intelligence?" Some school districts are adopting multi-faceted "body of evidence" portfolios which allow a student to be identified if they express multiple data points, including alternative substantiation, to affirm their gifted status. Inclusion of a measurement of curiosity, given that gifted literature has been announcing for years that it is a trait positively correlated with giftedness and this study has demonstrated empirically that there is a relationship, seems justified should there be a normed, age-appropriate screen available.

The Marland Report definition of giftedness doesn't leave a lot of room for desire, need, drive or potential for cognitive ability, although one can argue that curiosity could fall under the auspices of "general intellectual ability" or even the later half of "creative or productive thinking." However, the Elementary and Secondary Education Act of 1965 offers wording that opens the door for potentiality in gifted identification:

> …the term 'gifted and talented children' means children and, whenever applicable, youth, who are identified at the preschool, elementary, or secondary level as possessing demonstrated or *potential abilities* that give evidence of high performance capability in areas such as intellectual, creative, specific academic, or leadership ability, or in the performing and visual arts, and who by reason thereof, require services or activities not ordinarily provided by the school. (Gifted and Talented Children's Education Act, 1978)

A desire to acquire information at an exaggerated rate may be interpreted as evidence of "potential abilities." While the Javits Act offers no language that supports inclusion of potentiality in diagnostic criteria, the National Excellence report again utilizes the terminology "*potential* for performing at remarkably high levels of accomplishment."

Currently, school districts around the country utilize a variety of different criteria for identifying gifted and talented students within their ranks. Often, there is some sort of referral process from classroom teachers, most of whom are completely untrained in gifted identification. Many school districts use automatic identification based on high scores on standardized tests (which correctly identifies high-academic achievers, but not necessarily the gifted students in the population, especially those who are not currently working to their full potential). These two identification processes in particular are likely to result in glaring underrepresentation of non-white, low socio-economic status students (Hunsaker, 1994; Passow, 1996; Ford 1995, 1998; Courville & DeRouen, 2009; Erwin & Worrell, 2012).

There are a variety of reasons to think that teacher nomination, current intelligence testing methods, and demonstrated academic success may not be ideal methods for identifying students of low socio-economic status, or from African-American or Hispanic backgrounds stated in the literature review of this dissertation. As long as the definition or mission statement for gifted education includes language about "potentiality," the door is open for utilizing curiosity assessments for identification purposes, but states and districts that utilize multi-dimensional portfolio or "body of

evidence" files for gifted identification (Naglieri & Ford, 2003) are likely to find the most value in the results of this research.

Trait/State

The global state-trait model describes curiosity as both a trait (C-Trait) and a state of being (C-State); while the C-Trait is an inherent element of a person's personality, it is also built up by positive experiences in the C-State (Boyle 1983). Boyle, Richards and Baglioni provided evidence of epistemic curiosity being malleable (Boyle et al., 1993), which fits with descriptions of curiosity described by high-curiosity respondents in this research study. One interviewee described inherent curiosity as "a spectrum" where a person would vary between their particular high and low ranges of curiosity based on environmental factors. All high scorers on the curiosity inventories described times in which their curiosity waned, was exhausted, or was bypassed entirely.

The low-scoring interviewee, on the other hand, visualized curiosity as a state of being, and not based on a fixed trait at all. In his conception of curiosity, it was akin to laughter or frustration: a temporary and fleeting condition that affected everyone at some point. This was in direct contrast to the high-scorers, who were quick to describe themselves as "curious people" and for whom curiosity is an ever-present element of their lives. Boyle's global state-trait model was reflected further in the responses by the high scorers who described the self-perpetuating nature of inquiry: the conception of a "rabbit hole" where curiosity in one subject can generate additional questions which lead to a completely different line of inquiry. This was most exemplified by following links on one Wikipedia article after another until the subject matter is completely divorced from

the original search term. High-scoring interviewees described the development of curiosity like a skill, built up over time and repeated use. Every question asked (C-State) leads to more questions, which generates *diversive* curiosity (C-trait) along Berlyne's axes. This opinion was unique to the high-scorers on the curiosity measures; the low-scoring respondent viewed curiosity as exclusively a state, and therefore not something that could be established or improved.

The quantitative data collected seem to confirm the existence of the C-trait as well: it is unreasonable to assume that all high-level respondents to the measures, both in this study and in previous research conducted would happen to be in the midst of a fleeting state of mind that happened to be captured by the instrument in that particular moment. The results of both the I-Type and NFC instruments, which demonstrated a higher level of those measures in gifted students on average also seems to imply that there is a "baseline" of curiosity which differs between the two samples. There may be other explanations for the results, but this study hinges on the acceptance of the paradigm that there is a C-trait, which may or may not be affected over time by the presence of a C-state.

The I/D Paradigm

The foundations of this study are rooted in Berlyne's proposed distinctions between *perceptual* and *epistemic* curiosity: perceptual curiosity is a situational state of arousal triggered by introduction of novel stimuli, which is gradually extinguished by continued exposure, while epistemic curiosity is a uniquely human characteristic, describing the motivation to discover information (Berlyne, 1954, 1960). This distinction

did not originate with Berlyne, as something similar was suggested by both William James who described a two-fold model of "sensory" and "scientific" curiosity and John Dewey, who suggested a three-factor model of "physical," "social" and "intellectual" curiosity (James, 1890; Dewey, 1910).

This study has chosen to embrace Dr. Jordan Litman's I/D model (2004), which supposes that curiosity can be best defined as two factors, based on Interest ("I *want* to learn more") and Deprivation ("I *need* to resolve this question"). The I/D theoretical framework for looking at curiosity: the wanting (I)-liking (D) model, supposes two separate neural motivations for curious behavior. Interest-based (I-Type) curiosity is based on positive reinforcement of exploration as a pleasurable activity. Deprivation-based (D-Type) curiosity is defined by anxiety over things left ambiguous, unsolved, or undiscovered (Litman, 2004); D-Type curiosity is a desire to become motivated by unpleasant emotional states when it isn't satisfied (Litman, 2008). An analogy might be in comparing the pleasure in enjoying cuisine versus the biological need to sustain the body with food: it is possible to enjoy food without starving first, just as it is possible to choke down something unpleasant if it is necessary for survival.

Litman's I/D model maps, albeit clumsily to another axis of curiosity that Berlyne (1954) established: *specific* vs *diversive*. Specific curiosity relates to what the interviewees call "interest": solving a particular puzzle, for instance, or an obsession with a particular hobby. Diversive curiosity is more generalized and broad; a broad desire to learn new information, regardless of the subject, while specific epistemic curiosity is represented by a strong desire to know everything about a given subject. So while Low-

NFC in the qualitative research study may want to solve a particular problem to advance in his favorite video game, that is distinct from High-NFC's desire to explore multiple subjects and seek to find the linkage between them and to generally explore intellectual opportunities presented.

John Dewey (1910) also recognized the distinction between curiosity and interest. He supposed that when information is lacking, curiosity may occur, and that this can be turned into interest if the conditions are right. The interview subjects of this study suggest that he may have had it backwards, and that interest is a prerequisite for curiosity rather than the other way around. Interviewees described a sort of "filter," where things that weren't innately interesting to them were simply glossed over, while exposure to new information along existing lines of interest were passionately sought out.

The mean of the gifted sample was significantly higher than the mean of the non-gifted sample on the I-Type, which implies a greater desire in general for investigations that reward the pleasure center of the brain. Gifted students, on average, find the pursuit for new information to be more enjoyable than non-gifted students. On the other hand, the need to completely resolve lines of inquiry was not statistically higher among gifted adolescents than their non-gifted peers. Based on these results and the discussions with the highly curious interviewees in the follow-up qualitative research, it can be concluded that, for gifted students, the *process* of investigation and discovery is more important than the *results* of those activities.

Need for Cognition Scale

The Need for Cognition Scale, which dates back to 1982, is a psychometric instrument to measure "the tendency for an individual to engage in and enjoy thinking" (Cacioppo & Petty, 1982, p. 116). The Need for Cognition Scale is a measure of individuals' tendencies to pursue and enjoy the process of cognition, (Cacioppo & Petty, 1982; Cacioppo, Petty, Feinstein, & Jarvis, 1996; Cacioppo et al., 1984; Sadowski, 1993; Sadowski & Gulgoz, 1992) and has been positively correlated with epistemic (but not diversive) curiosity (Olson et al., 1984; Mussel, 2010; Litman & Mussel, 2013).

The use of the Need for Cognition scale yielded mixed results, with both GT and non-GT means suspiciously divergent from reported historical values. Therefore, only GT and non-GT results have been compared for the purposes of this study. According to the data gathered, gifted and talented adolescents as a mean are significantly higher than the mean of non-GT respondents. Unlike on the I-Type measure, gender was not a factor.

Without the academic weight of previous studies to compare the results of this study to, it may be hasty to read too much into the differences between the gifted and non-gifted samples. That said, the measurement of the means between the two samples that participated in this study was striking. If the non-GT sample is, in fact, representative of the population of non-GT adolescents in general, then NFC demonstrates a marked distinction between the two groups absent of the confounding factor of gender, with a higher effect size and greater statistical significance than the data from the I-Type measure.

Recommendations for Future Research

The broader goal of the research conducted in this study was to lay the foundation for new methods and tools of gifted identification that could better recognize Black, Hispanic, and low-income students. With that in mind, it is essential to determine if curiosity inventories are also culturally or economically biased. The Interest/Deprivation Scale and NFC scale should be applied to a broad heterogeneous adolescent population where demographic features other than gender and giftedness can be charted. A larger sample of non-GT students also needs to take the Need for Cognition scale to see if the difference between GT and non-GT populations is as profound as this limited study seems to imply. If the limited sample (n=36) is actually representative, then the use of the NFC in gifted identification or in gifted research becomes more tenable.

Testing the Interest/Deprivation Scale and Need for Cognition Scale on different cultural, racial, ethnic and abled groups should be the first priority of subsequent research into curiosity as a gifted identification tool. If it is culturally neutral within a statistically significant margin, it may be applied reasonably as part of a multi-faceted assessment, or as a screen to determine the need for further assessment. If it is, however, culturally biased, than it is merely another tool for reinforcing the current hegemony of white middle class students in gifted education.

Secondly, an Interest/Deprivation Scale or adaptation of the Need for Cognition Scale needs to be developed and normed for students of the age where identification most frequently occurs (2nd or 3rd grade). When such a tool exists, and when a baseline for curiosity has been established for a non-GT population, this research study should be

conducted again on that age group. If future research demonstrates that the trends seen in this adolescent study also pertain to young elementary age students as well, a stronger case could be made for the use of curiosity assessments in the identification process.

Given that exploratory epistemic curiosity and a joy in cognitive exercise are measurably higher in the means of the gifted population, further research must be conducted to determine causation rather than simply correlation. If gifted students become curious through identification rather than innately possessing high levels of curiosity, then the commonly-stated view that gifted students are inherently curious (Colangelo, 2003) must be completely re-examined, and the elements of gifted education that might be responsible will have to be more closely analyzed. While this would invalidate curiosity as a tool of identification, it would open up a whole range of further research opportunities into effective gifted curriculum. Conducting follow-up studies with young children who have only recently been identified might shed light on how much of a role gifted curriculum has on the trait of epistemic curiosity.

Recommendations for Future Practice

It is too early to implement a broad curiosity inventory as part of a rationale for gifted identification, but with the demonstration of higher average seeking/exploring curiosity and Need for Cognition in the gifted populations, perhaps it could already be used to "flag" students who might benefit from a further investigation. Middle class white students may have parents with social capital who are adept at navigating their children's educational system and thus more prone to advocating for their child's inclusion in gifted programs; a tool used to highlight high curiosity may provide an initial referral into the

identification process for students whose parents are not as comfortable with school bureaucracy (specifically the underrepresented populations mentioned in this study).

Regardless of the adoption of a curiosity inventory as part of gifted and talented identification or not, something clearly must be done to address the disparity between able white middle class students and their peers who are Black, Hispanic, in poverty, or non-neuronormative. Gifted students exist in every ethnic and cultural group, and need services. Gifted education must be equitable and intersectional, or else all accusations of elitism leveled against gifted programing have at least a modicum of truth.

Summary

It seems apparent through this research that expressions and degrees of curiosity vary between gifted and non-gifted populations with the former having higher degrees than the later. On its face, this provides evidence to support commonly stated "common knowledge" within the domain of gifted and talented research. It also establishes the foundations for utilizing curiosity psychometrics in the identification of underrepresented populations, who are currently excluded from gifted and talented education for a variety of reasons.

There are a number of groups who are currently underrepresented in gifted education in America, including students of color who are disproportionately represented in disciplinary actions and special education, but significantly and egregiously underrepresented in gifted programming. Students who have disabilities, or who have other factors that may mask their identification such as ADHD or Autism Spectrum

Disorders –so-called Twice Exceptional, 2E or 2X students- are also excluded from easy identification according to most district criteria.

Part of this quandary involves testing for ability rather than potential. If gifted education providers look for the traits that indicate future success in gifted programming, rather than students who are already demonstrating their gifts academically, they will catch low income students before they are outpaced by middle class peers with access to extracurricular enrichment, students of color before the documented "achievement gap" with white middle class students becomes insurmountable, and twice exceptional students while the factors that mask their giftedness are still being discovered.

A multi-faceted "body of evidence" identification procedure is wonderful, but if it only provides multiple sequential checkpoints rather than multiple avenues for entry, than it doesn't serve its intended purpose. A screen for curiosity provides a true alternative gateway to an identification process. The research is far from complete, but does begin an inquiry that will ultimately benefit underserved gifted students.

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Appendix A: Scales

Interest/Deprivation Scale (Litman, 2008)
A number of statements that people use to describe themselves are given below. Read each statement and then select the appropriate response using the scale below to indicate how you generally feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer that seems to describe how you generally feel.

1 = Almost Never
2 = Sometimes
3 = Often
4 = Almost Always

1. I enjoy exploring new ideas.
2. Difficult conceptual problems can keep me awake all night thinking about solutions.
3. I enjoy learning about subjects that are unfamiliar to me.
4. I can spend hours on a single problem because I just can't rest without knowing the answer.
5. I find it fascinating to learn new information.
6. I feel frustrated if I can't figure out the solution to a problem, so I work even harder to solve it.
7. When I learn something new, I would like to find out more about it.
8. I brood for a long time in an attempt to solve some fundamental problem.
9. I enjoy discussing abstract concepts.
10. I work like a fiend at problems that I feel must be solved.

*Need for Cognition Scale (Full) (*Cacioppo & Petty, 1982)

A number of statements that people use to describe themselves are given below. Read each statement and then select the appropriate response using the scale below to indicate how you generally feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer that seems to describe how you generally feel.

1 = Strongly Disagree
2 = Disagree
3= Neither Agree Or Disagree
4 = Agree
5 = Strongly Agree

1. I would prefer complex to simple problems.
2. I like to have the responsibility of handling a situation that requires a lot of thinking.
3. Thinking is not my idea of fun.
4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.
5. I try to anticipate and avoid situations where there is likely a chance I will have to think in depth about something.
6. I find satisfaction in deliberating hard and for long hours.
7. I only think as hard as I have to.
8. I prefer to think about small, daily projects to long-term ones.
9. I like tasks that require little thought once I've learned them.
10. The idea of relying on thought to make my way to the top appeals to me.
11. I really enjoy a task that involves coming up with new solutions to problems.
12. Learning new ways to think doesn't excite me very much.
13. I prefer my life to be filled with puzzles that I must solve.
14. The notion of thinking abstractly is appealing to me.
15. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.

16. I feel relief rather than satisfaction after completing a task that required a lot of mental effort.
17. It's enough for me that something gets the job done; I don't care how or why it works.
18. I usually end up deliberating about issues even when they do not affect me personally.

Appendix B: Interview Protocol

Primary Research Question: Is high epistemic curiosity positively related to giftedness?
Sub-questions: How does epistemic curiosity manifest in gifted populations? To what extent does the quantitative and qualitative data converge? How and why?

Questions for the first interview:

- Ask, *I'm interested in learning about conceptions of curiosity and would like to hear how you perceive it.*
- From the resulting discussion, look for specific subjects of curiosity to follow up on. Ask how an interest in the areas brought up feel when experienced.
- Ask, *Do you remember what it was like to be curious as a child? Can you give me an example?*
- Ask, *I'm interested in learning more about your emotional state when you are presented with something new or novel. Can you elaborate?*
- From the resulting discussion, ask about key points. For example, *You mentioned that you sometimes feel anxious when presented with puzzles you don't think you can solve. Can you tell me more about that?*
- Ask, *What does it take for you to feel your curiosity about something has been resolved?*
- Ask, *Do you ever feel that your curiosity has been left unresolved? Tell me more about that.*
- Ask, *are there times you feel more curious than others?*
- From the resulting discussion, ask the participant to reflect on why they might feel more or less curious in those situations.
- Ask, *What do you think of the saying, "curiosity killed the cat?"*
- At the end of the interview, explain that you will explore some more of these areas more deeply at the next session. Ask the participant to make a note of anything that comes up in the time between interviews that might be of interest.

Questions for the second interview:

- Ask, *Have you given any thought to anything we talked about last time? Is there anything you'd like to add?*
- Ask, *Do you feel that your level of curiosity has changed over the course of your lifetime, or has it generally remained the same?*
- From the resulting discussion, make sure to probe why they feel one way or another.
- Ask, *How do you feel when you can't solve a puzzle or problem?*
- Ask, *Do you ever feel bored? How do you deal with boredom?*
- Ask, *What do you think the purpose of education is?*
- From the resulting discussion, ask *What do you think the purpose of education should be?*

- Ask, *Do you find school to be challenging?*
- If the answer is no, ask why not. Ask whether that is a good thing or not. If they indicate that they want more challenge, ask what would improve that.
- Ask, *Do you find school to be interesting or rewarding?*
- From the resulting discussion, ask about what elements are gratifying and which are frustrating.
- Ask, *Do you have any new insights into the nature of curiosity after having had these interviews?*

Appendix C: Permission Forms

University of Denver (DU) Institutional Review Board

Parent or Legally Authorized Representative Permission for Participation in Research

DU IRB Approval Date: April 13, 2016 Expiration Date: March 15, 2017
Study Title: Curiosity in Adolescent Gifted Populations
Researchers: Cameron Hays and Norma Hafenstein, University of Denver

DESCRIPTION:
Your child is invited to participate in a research study on characteristics and academic behaviors of gifted and talented high school children. Your child will be asked to complete a 28 question survey that asks how they feel about various elements of learning and problem-solving.

RISKS AND BENEFITS:
There are no risks associated with this study. The benefits which may reasonably be expected to result from this study include improving the way that gifted students are identified, and how students are paired with engaging and challenging curriculum. We cannot and do not guarantee or promise that your child will receive any benefits from this study. Your decision whether or not to allow your child to participate in this study will not affect your child's grades or participation in school.

TIME INVOLVEMENT:
Your child's participation in this experiment will take approximately 20 minutes.

PAYMENT:
Your child will receive a $5 gift card as payment for his/her participation.

SUBJECT'S RIGHTS:
Your child's participation is voluntary and your child has the right to withdraw his/her consent or discontinue participation at any time without penalty or loss of benefits to which he/she is otherwise entitle. Your child has the right to refuse to answer particular questions. Your child's individual privacy will be maintained in all published and written data resulting from the study.

CONTACT INFORMATION:
The researcher carrying out this study is Cameron Hays. You may ask any questions you have now. If you have questions later, you may call Cameron Hays at 303-715-3822 or chays23@du.edu or faculty advisor Norma Hafenstein at 303-871-2527 or nhafenst@du.edu.

If you have any questions or concerns about your research participation or rights as a participant, you may contact the DU Human Research Protections Program by emailing IRBAdmin@du.edu or calling (303) 871-2121 to speak to someone other than the researchers.

Please take all the time you need to read through this document and decide whether you would like your child to participate in this research study. If you agree to allow your child to participate in this research study, please sign below. You will be given a copy of this form for your records.

_____ _____
Signature(s) of Parent(s), Guardian or Conservator Date
Name of Child(ren) allowed to participate in the study _____
DU IRBNet ID #839249
Version IRB Approved 4/13/16 Valid Through 3/15/17
DU IRB Approval Date: April 13, 2016 Expiration Date: March 15, 2017

Re-contact Form

Study Title: Curiosity in Adolescent Gifted Populations
Researchers: Cameron Hays and Norma Hafenstein, University of Denver

Thank you for letting your child participate in the first part of the research project about Gifted Education. Your child may be eligible for participating in the second part of the study. If this is of interest to you, please provide me your name and contact information. I will be in contact with you if you are randomly selected for the second part of the project.

In the second part of the study, I will conduct 2 one hour interviews with some of the participants from the study first part of the study. The interview will focus on questions about interests and habits. This will help me understand potential differences between gifted and non-gifted students. The interview will occur in a few months.

For data analysis purpose, I will need to audio record the interview with your child. I am just making sure I hear every word that your child says. No one else except me will have access to the audio files. The recording of the interview will be erased after the study is finished and it will not be presented in any public presentation.

Up to 6 children will be randomly selected to participate in this part of the study. If you are interested, please complete the information below. If selected, your child will be compensated additionally for participating in this study. Participation in the second part of the study is totally voluntary.

Please check the following:

_____ I agree that if my child is selected for participating the part two study, the researcher can audio record the interview process for data analysis purpose only.
_____ I prefer to be contacted via: Email Telephone Mailing Address (circle one)

Contact Information:
First Name Last Name

Address Line 1

Address Line 2

Telephone Number (preferred)

Email

Re-contact Consent Form

Parent or Legally Authorized Representative Permission
Approval Date: Valid for Use through:

DESCRIPTION:
Thank you for your participation in the first phase of this research study. Your teenager has been selected to be one of a very small number of voices that give deeper insight into the results of the survey from the first phase. This will involve two interviews, each about 1 hour long. These interviews will be audio-recorded. The transcript of the interview will be made available to your child so that they may correct or revise their responses, and the original recordings will be destroyed. All identifying information will be altered when the information is presented, to protect the privacy of your child.

RISKS AND BENEFITS:
The risks associated with this study include unlikely but possible security breaches which would expose your child's identifying information. To keep your child's information safe, the researchers will keep the data on a password-protected computer using special software that scrambles the information so that no one can read it. The data your child provides will be stored in an isolated electronic archive. The researchers will retain the data for 5 years. Although we will do everything we can to keep your records a secret, confidentiality cannot be guaranteed.

TIME INVOLVEMENT:
Your child's participation in this experiment will take approximately 2 hours.

PAYMENT:
Your teenager will receive a $20 gift card as payment for their participation in Phase 2 of this research study.

SUBJECT'S RIGHTS
If you have read this form and have decided to allow your child to participate in this project, please understand your child's participation is voluntary and your child has the right to withdraw his/her consent or discontinue participation at any time without penalty or loss of benefits to which he/she is otherwise entitle. Your child has the right to refuse to answer particular questions. Your child's individual privacy will be maintained in all published and written data resulting from the study.

CONTACT INFORMATION:
The researcher carrying out this study is Cameron Hays. You may ask any questions you have now. If you have questions later, you may call Cameron Hays at 303-715-3822/chays23@du.edu or faculty advisor Norma Hafenstein at 303-871-2527/ nhafenst@du.edu.

If the researchers cannot be reached, or if you would like to talk to someone other than the researcher about questions, concerns, or complaints regarding this study, research participant rights, research-related injuries, or other humans subject issues, you may contact the Chair of the Institutional Review Board for the Protection of Human Subjects at 303-871-4015 or by e-mailing IRBChair@du.edu. You may also contact the Office of Research Compliance by calling 303-871-4050 or e-mailing IRBAdmin@du.edu or in writing to: University of Denver, Office of Research and Sponsored Programs, 2199 S. University Blvd., Denver, Colorado 80208-2121.

Indicate Yes or No:

I give consent for my child to be audiotaped during this study:
_____Yes _____No

I give consent for tapes resulting from this study to be used for (describe proposed use of tapes):
_____Yes _____No

I give consent for my child's identity to be revealed in all written data resulting from this study:
_____Yes _____No

_____
Signature(s) of Parent(s), Guardian or Conservator Date

Mailing Address

Email

Phone

A copy of this signed and dated consent form is for you to keep.