

Dudley Weldon Woodard and the Graduate Program in Mathematics at Howard University

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Abstract

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Historically Black Colleges and Universities (HBCUs) graduate a large number of Black students who receive graduate degrees in science, engineering, technology, and mathematics (STEM) (Einaudi et al., 2022; Cooper, 2004; National Science Foundation, 2008; Shuler et al., 2022; Upton & Tanenbaum, 2014). Researchers have examined this phenomenon to better understand how these mathematics departments prepare their student's for PhDs in mathematics. Howard University has a long history of supporting Black students and Faculty. Howard is among the top HBCUs to produce Black students who go on to receive PhDs in mathematics (Einaudi et al., 2022) and the mathematics department at Howard was well known for doing advanced mathematics during the early parts of the twentieth century (Donaldson & Fleming, 2000; Parshall, 2016; Walker, 2014). Mathematician and mathematics educator Dudley Weldon Woodard (1881-1965), the second African American to earn a PhD in mathematics spent the second half of his career at Howard University and was instrumental in the development of graduate studies at Howard, though not much is known about his life and career. By exploring both Woodard's life and career we understand better the foundational impact he had on Howard University's mathematics department and support of Black students in mathematics. This dissertation is a historical case study which examines the life and career of mathematician Dudley Weldon Woodard and his involvement in the establishment of graduate work at Howard University. With the use of archival documents like governmental records, course catalogs, commencement programs, yearbooks, and newspapers, this study weaves together the details of

Woodard's early life, education and early career all of which led him to Howard University. This study also examines Woodard's contributions to the establishment of the masters program in mathematics at Howard University and his mentorship of students in the program. Woodard was instrumental in formalizing graduate studies throughout Howard University. His commitment and leadership laid a strong foundation for the mathematical sciences at Howard University and beyond, by seeding teachers, faculty, and researchers in the mathematical sciences whose contributions are still felt today.

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Dedication

This dissertation is dedicated to the memory of Dudley Weldon Woodard and William Schieffelin Claytor. Thank you for your contributions to the field of mathematics and mathematics education. Thank you.

Chapter 1: Introduction

1.1 Need for Study

Historically Black Colleges and Universities (HBCUs) graduate a large number of Black students who receive graduate degrees in science, engineering, technology, and mathematics (STEM) (Einaudi et al., 2022; Cooper, 2004; National Science Foundation, 2008; Shuler et al., 2022; Upton & Tanenbaum, 2014). These students then go on to do research and have successful careers in STEM (National Center for Science and Engineering Statistics, 2022). Still, Black mathematicians make up less than 2% of mathematicians in the United States (National Center for Science and Engineering Statistics, 2022; Cooper, 2004). We can address this problem by understanding what mathematics departments do to prepare undergraduates who earn PhDs in mathematics.

Many researchers have focused on HBCUs to understand their role in the STEM education of African American students. But these studies often focus on students—their experiences, reasons for choosing HBCUs, and mathematics identities (Toldson et al., 2021; Jett, 2013; Lewis et al., 2011, Upton & Tanenbaum, 2014) or the focus of the studies are the undergraduate programs (Leichter, 2016) rather than graduate programs. Also, most of those studies are quantitative (Owens, 2012). Far fewer studies examine the processes and practices of these programs, more specifically, the mathematics departments at these institutions or through a historic lens. Some researchers have done qualitative work to understand successful mathematics departments that graduate mathematicians with advanced degrees. For example, Cooper (2000) studied the mathematics department at the University of Maryland to understand the practices of

the department that lead to a large number of Black graduate students pursuing PhDs. From this study, Cooper found that one individual faculty member can make an immense difference but departmental support is recommended. Jett (2022) wrote about the mathematics department at Morehouse College through the experiences of a cohort of Black male students in the department. The Morgan-Potsdam Miracle, for example, examines the practices and processes put in place by Clarence Stephens at Morgan State University (an HBCU where he had great success preparing undergraduates for graduate mathematics study) and later SUNY Potsdam. Stephens believed that “every college student who desired to learn mathematics could do so” (Houston, 2018, p. 848) and he developed his teaching philosophy around teaching students how to read and understand the textbook and think logically about it (Datta, 1993). But it is worth studying other mathematics departments at HBCUs to understand how they contribute to the pool of Black PhDs in the United States. Walker (2014), who wrote about the lives of Black mathematicians in *Beyond Banneker: Black Mathematicians and the Path to Excellence*, called for such studies. Undoubtedly, Howard University and their mathematics department has a rich history of supporting Black students as well as hiring Black mathematicians during a time when other white institutions actively would not hire them.

Founded in 1867, Howard University is a historically Black university in Washington DC. It was the top HBCU to award the most bachelor’s degrees to Black students who eventually received PhDs in the STEM field in 2010-2020 (Einaudi et al., 2022). Prior to this, in the early to mid 20th century, Howard was also home to many early Black mathematicians who were denied employment at white institutions due to race-based discrimination. The mathematics department at Howard was well known for doing advanced mathematics during this time (Donaldson & Fleming, 2000; Parshall, 2016; Walker, 2014). Among those early Black mathematicians was

Dudley Weldon Woodard, the second African American to receive a PhD in mathematics. Woodard is credited for starting the masters program in mathematics at Howard. In addition to this, before he retired in 1947, he recruited other Black mathematicians to join the faculty, including Elbert Cox, the first African American to receive a PhD in mathematics. Further, he taught and mentored a number of Black students who also went on to receive PhDs in mathematics, like William Claytor, the third African American to receive a PhD in mathematics. Claytor was a student of both Woodard and Cox, one of the first students enrolled in the master's program in mathematics at Howard, and received his PhD at the University of Pennsylvania under the same advisor as Woodard.

Dudley Weldon Woodard was born in 1881 in Galveston, Texas. He earned a bachelor's degree in mathematics from Wilberforce University (Woodard, n.d.), a historical black university in Ohio, in 1903. He received a second bachelor's and a master's in mathematics from the University of Chicago in 1906 and 1907, respectively (University of Chicago, n.d.a). After receiving his master's degree, Woodard taught at the Tuskegee Institute for the next seven years. While at Tuskegee, Woodard published a textbook, a study of the teaching of geometry, and a study on the conditions in Jackson, Mississippi; *Practical Arithmetic* (1911), *The Teaching of Geometry at Tuskegee* (1913), and *Negro progress in a Mississippi town, being a study of conditions in Jackson, Mississippi* (1909). Next he returned to Wilberforce as a faculty member and taught for six years (Local Board for Greene County Ohio, 1918; Wilberforce University, 1916). In 1920, Woodard joined the faculty at Howard University and served as the Dean of the Arts and Sciences for nine years (Logan, 1969). In 1927, Woodard took scholarly leave from Howard (Woodard, n.d; The Evening Star, 1938; Logan, 1969; The Washington Tribune, 1928). He spent the year at the University of Pennsylvania working on his dissertation. Once Woodard

earned his PhD (Woodard, n.d; The Evening Star, 1938; The Washington Tribune, 1928), becoming only the second African American to do so in mathematics, he returned to Howard. Woodard was the first African American mathematician to publish a research paper in an international accredited journal. He was also the first African American mathematician to have attended an HBCU as an undergraduate.

HBCUs continue to educate a significant proportion of Black students in STEM and Howard University continues to be among the top HBCUs to graduate and prepare these students for STEM PhDs. Woodard, in starting the graduate program, was instrumental in laying the foundation for the mathematical sciences at Howard University and beyond, by seeding teachers, faculty, and researchers in the mathematical sciences whose contributions are still felt today. This study seeks to contribute a much needed perspective to the historical record, particularly in the fields of mathematics and the history of science. Further, institutions seeking to support Black students and faculty in mathematics will benefit from this study of Woodard's career and leadership and the practices of the mathematics department at Howard, which educated, recruited and hired Black mathematicians at a time when predominantly white institutions would not. Thus, this project seeks to find and analyze historical evidence about Woodard's significant contributions to mathematics at Howard and to the field more generally.

1.2 Purpose of Study with Research Questions

The purpose of this historical study is to explore the life and career of Dr. Dudley Weldon Woodard, the establishment of the graduate program in mathematics at Howard University, and Woodard's contribution to the genesis of this program. Ultimately, this study seeks to understand how Howard University promoted success in mathematics, especially via departmental and university practices and processes, through the life and work of Woodard.

To achieve this purpose, the study addresses the following research questions:

1. What can be discovered about Dudley Weldon Woodard's life and career in mathematics and mathematics education?
2. What were the circumstances around the establishment of Howard University's graduate program in mathematics?
 - a. What was the organization and structure of the program, and how did this evolve over time? For example, what were the requirements for the program?
 - i. Requirements for admission?
 - ii. Required courses?
 - iii. Requirements regarding master's thesis or special project?
 - iv. Different iterations of degree requirements?
 - b. What were Woodard's contributions?
3. How did Woodard and other faculty members at Howard mentor students in the master's program and beyond?

1.3 Procedure

Conducting a historical case study consists of using primary and secondary sources to interpret the details of a specific person or event from the past (Lune, 2017). As defined by Schrag (2021), "history is the study of people and the choices they made" (p. 9). I used archival sources to get a better understanding of Dudley Weldon Woodard and the choices he made which led him to earning the highest degree in mathematics and laying the foundation for graduate work at Howard University. To conduct this historical case study, I examined and analyzed documents about Dr. Dudley Weldon Woodard's life, his career as a mathematician and mathematics educator, and works that document the history of Howard University's graduate

program in mathematics, focusing on the mathematical sciences and the progression of programs related to the discipline.

To address my first research question, I reviewed written materials by and about Woodard and any materials published about his life and work. I looked at federal and local government records to establish a timeline of Woodard's life, such as census records, city directories, school records, and birth and death records. To learn more about Woodard's career in mathematics and mathematics education, I reviewed artifacts belonging to the archives of Howard University, Tuskegee Institute, Wilberforce University, The University of Pennsylvania, and Columbia University. I examined faculty files and biographies, student newspapers, and university documents with these archives. Finally, I visited the Washington D.C. archives, for local newspapers and other periodicals that may shed light on Woodard's life and career as a mathematician and educator.

To address my second research question, which looks at the practices and processes of the graduate program in mathematics at Howard University, I searched the university's archives for course catalogs, university newspapers and journals, faculty and biography files. In addition, I looked at local newspapers, other periodicals, and papers related to Woodard's leadership roles at the university. I reviewed these sources to discover the circumstances of the beginning of the graduate program in mathematics and Woodard's contributions. *The Howard Review*, for which Woodard served as the editor-in-chief, newspapers, school records, course catalogs, and scholarly publications also served as data sources for this question.

To address my third research question concerning Woodard's mentorship and leadership roles, I examined archives at the colleges and universities he was affiliated with for documents related to Woodard's life—for example, the files of other faculty who Woodard taught or worked

with, academic and other papers written by Woodard's students and colleagues. Also, I examined yearbooks to establish a list of Woodard's students and any writings or recollections attributed to them.

Chapter 2: Literature Review

This chapter gives an overview of the research in the various areas relating to Dudley Weldon Woodard and the graduate program in mathematics at Howard University. To put Woodard's story and graduate study at Howard into perspective, I will briefly discuss the beginnings of HBCUs – when and why they were established, the type of education they provided and how they received funding. Then I will discuss how the missions of HBCUs evolved over time. There were differing opinions on the type of education that should be provided at HBCUs, a classical liberal education vs. a vocational focused education and there were people who believed Black colleges and universities should not exist at all. The type of education a HBCU offered was closely aligned with the type of funding they received. With Howard University being a private college funded in large part by northern white missionaries and black church funds (Wade, 2021), the university offered a classical liberal arts education and was among the first HBCUs to offer graduate studies. Lastly, I will discuss research studies examining mathematics departments that have been successful in supporting Black students and their findings.

2.1 The Beginning of Historically Black Colleges and Universities

Beginning in the 1800s, historically Black colleges and universities (HBCUs) were founded to address the educational needs of newly freed enslaved people in the South. African Americans have always held a desire to learn to read and write as they believed their freedom depended on it (Anderson, 1988; Davis, 1993; Perry, 1993). However, during slavery it was illegal for enslaved people to learn to read or write (Anderson, 1988). Some still found ways around this by, what Carter G. Woodson (1939) called, “snatching learning from forbidden

fields” (p. 21). They taught themselves through observation, proximity to their white owners, and stealing pages from books (Givens, 2021; Robinson, 2020; Anderson, 1988); some were taught in secret by benevolent white owners (Robinson, 2020; Anderson, 1988). However, even with these efforts, after the Civil War at least 90% of newly freed slaves were illiterate (Albritton, 2012; Anderson, 1988; Holmes, 1934) and people - parents, ministers, community leaders - took up the cause of the education for Black people. W.E.B. DuBois said, “Public education for all at the public expense was, in the south, a Negro idea” (Anderson, 1988, p. 6).

HBCUs were started in areas with large black populations, such as the South and Northeast. The first Black college in the United States was Cheyney State University founded in Pennsylvania in 1837 (Evans et al., 2002; O'Connor, 2023; Crosby et al., 2021; Wade, 2021). Cheyney, originally The Institute for Colored Youth, was founded upon “community cultural wealth” (Yosso, 2005, p. 70) with funds from black churches and social organizations in Philadelphia. It started as a private secondary school with some primary instruction before evolving into the first Black college (O'Connor, 2023). With the passing of the Free Public School Act in 1834, many public schools for white students opened with very few primary and grammar schools for African Americans (O'Connor, 2023). Because few free African Americans had access to the schools for white students, Black businessmen and community leaders called for two things, “(a) schools to educate African American children in skilled trades and (b) trained African American teachers to staff schools” (O'Connor, 2023, p. 4). The Institute for Colored Youth was founded by the Philadelphia Quaker community in 1837 with these goals in mind (O'Connor, 2023). Cheyney remained a secondary school for nearly a century until it awarded its first college degree in 1932 (O'Connor, 2023).

Cheyney was not unique among HBCUs in offering primary and secondary educations to African Americans. Though communities did what they could to provide primary and secondary education for Black children like starting one room schools or using churches as a place for learning, many early HBCUs served as primary schools, teaching basic skills like reading and writing (Anderson, 1988; Logan 1958). Since it was illegal during slavery for enslaved people to learn to read or write or be taught how to, these were skills that needed to be learned prior to beginning collegiate course work. In addition to this, after slavery was abolished there was a lack of satisfactory, if they existed at all, elementary and secondary schools in the South, so HBCUs stepped in to help with the elementary and secondary education for Black people in the South. At the beginning of the 20th century only 58 of the 99 colleges for African Americans had students enrolled in college courses (Anderson, 1988; Badger, 1952). In 1915, after World War I, only 33 of the 99 Black colleges were teaching any classes at the collegiate level (Anderson, 1988). “Of the 12,726 students attending these institutions in 1915, 79% were in the elementary and secondary grades. (Anderson, 1988, pg. 249).” A 1917 survey by Thomas Jesse James showed that only one of the 16 black federal land-grant schools, Florida Agricultural and Mechanical College, in the south taught at the collegiate level (Anderson, 1988; Gasman, 2025; Jones, 1917).

Other Black students enrolled in college courses during this time attended private HBCUs like Howard University (Anderson, 1988). Howard University, which started as a seminary and normal school, also implemented a preparatory department and model school, offering elementary levels, for students who needed the necessary preparation for collegiate work (Dyson, 1941). Howard conferred its first professional degree (Phar.D) in 1870 and first college degrees (A.B.) in 1872 (Howard University, 1919a). Other well known HBCUs like Spelman College and Wilberforce University offered elementary classes in addition to collegiate level classes

(Anderson, 1988; McGinnis, 1940). These schools awarded their first college degrees in 1901 and 1870, respectively.

Though private HBCUs provided most of the collegiate education for Black citizens during this time (Kujovich, 1993; Slater, 1996), attending a private institution was not an opportunity available for everyone, serving mainly the already well-to-do and professional class. Land grant institutes made college more widely available to the working class and Black citizens, though not without complexity. The First Morrill Act, passed in 1862, provided federal funding for land grant institutions but many of these colleges were in segregated states and did not admit Black students (Act of July 2, 1862 (Morrill Act), 1862; Kujovich, 1993). To address whether states should require land grant colleges to admit Black students, the Second Morrill Act, passed in 1890, stipulated that “no money shall be paid for the support of college where a distinction of race or color is made in the admissions to students (Act of August 30, 1890 (Second Morrill Act), 1890, S. 9-4)” and required states to either create a second land grant institution serving Black students or demonstrate that their admission practices did not exclude students based on race (Act of August 30, 1890 (Second Morrill Act), 1890; Davis, 1993; Kujovich, 1993). This led to the establishment of many historical Black land grant institutions, like the State Agricultural and Mechanical Institute for Negroes (now Alabama A&M) and Florida Agricultural and Mechanical College for Negroes (now Florida A&M) (Davis, 1993; Kujovich, 1993; Slater, 1996). However, a long period of disproportionate distribution of funding between white and Black institutions followed (Kujovich, 1993), with many examples still present today with HBCUs in Maryland, Florida and Georgia suing over discriminatory funding (Gasman, 2025; Stephenson & Pierre, 2025).

During this period, there were some white colleges and universities that admitted Black students, namely institutions in the north. Oberlin College, for example, made the decision to admit Black students in 1835 (Kujovich, 1993; Waite, 1996). In 1823 Alexander Lucius Twilight graduated from Middlebury College in Vermont. Then in 1826 two college degrees were awarded to Black students, John Russwurm from Bowdoin College in Maine and Edward Jones from Amherst College in Massachusetts. These are believed to be the first college degrees awarded to Black students (Slater, 1994). Though there were white institutions that admitted and graduated Black students, the number of Black students these opportunities were available was very small with only 40 recorded accounts of Black students earning college degrees before 1865 (Slater, 1994) and only 390 college degrees awarded to Black students between 1865 and 1900 (Slater, 1996).

For African American students in the south who wanted to attend graduate school, many states in the south passed laws to give out ‘segregation scholarships.’ Graduate studies at the historically Black public colleges and universities in the south were rare and instead of admitting Black students into the public colleges and universities that served white students, states like West Virginia, Maryland, Louisiana, and Mississippi gave funding to Black students to attend already integrated schools in the north (Sanders, 2024). In most of these states the funding that was provided was only for the difference in local tuition compared to the out of state tuition and some states only gave the funding as a reimbursement, thus continuing to set obstacles for African American students who wanted to pursue higher education (Sanders, 2024). Teachers College was a popular option for those who wanted to earn graduate degrees in education and become teachers (Sanders, 2024; Waite & Crocco, 2004). According to Sanders (2024) in 1947,

“more than one-fourth of the 18,000 public-school teachers pursuing graduate work at the New York City institution were Black educators from the south” (p. 121).

There exists both private and public historically black colleges. As mentioned above, many public historically black colleges and universities were established as a result of the Second Morrill Act (Davis, 1993; Kujovich, 1993; Slater, 1996) to provide a separate college education for Black students. The First Morrill Act made federal funds available for public, land-grant colleges. However, when the act was passed in 1862 only three states, Mississippi, Virginia and South Carolina, shared the funds with schools that served Black students. Other acts like the Hatch Act passed in 1887 made available federal funds for industrial training for all public institutions in the south and experienced a similar disproportionate distribution of funds to colleges serving Black students (Gasman, 2025).

Other sources of funding for HBCUs came from northern missionaries, philanthropists, churches and community funds. Southern states gave insufficient aid if any towards state sponsored schools thus Black and white churches and northern philanthropy provided funding for HBCUs (Anderson, 1981; Logan, 1958). “Northern mission societies, which were most prominent in the early crusade to establish institutions of higher education for the ex-slaves, were also largely responsible for sustaining the leading black colleges” (Anderson, 1981, p. 239). They are responsible for the establishment of colleges like Fisk University, Talladega College, Tougaloo College, Bennett College, Clark University, Claflin College, Meharry Medical College, Morgan College, Philander Smith College, Rust College, Wiley College, Benedict College, Bishop College, Morehouse College, Show University, Spelman Seminary, Virginia Union University, Atlanta University, Leland University and Howard University. For example Spelman College, a women’s college in Atlanta, was founded by two white missionaries from

Massachusetts who received their funding from the local Black community and churches but the majority of their funding came from John D. Rockefeller and the Rockefeller Foundation (Lefever, 2005). Industrial philanthropists were in support of the Hampton Institute and schools that followed the Hampton-Tuskegee model (Anderson, 1988), discussed further below. They felt industrial education was necessary to ensure the southern economy and thus gave a substantial amount of money to schools that provided an industrial education (Anderson, 1988; Gasman, 2025).

Howard University is an interesting case because although it is a private university it has received federal funding since its founding. In addition to private funds from philanthropists, Howard has received an annual subsidy which was approved by Congress in 1879 and formalized in 1928 (Gasman, 2025).

2.2 Classical vs Agricultural Education

The purposes and missions of HBCUs continued to evolve over time. Leaders in the fight for education for African Americans had differing opinions on the type of education they believed would most benefit African Americans and prepare them for a future in the United States. Some supported a classical liberal arts education, others thought an agriculturally-focused education was best. However, both sides believed the role of higher education for Black people in the South was to create a strong group of Black leaders who would then lead and educate the masses but they disagreed on the ideals and philosophies these leaders should have. And of course there were those who felt African Americans should not have access to education or higher education at all (Anderson, 1988). These differing ideals are usually aligned with the types of funding institutes received.

Industrial philanthropists supported the Hampton-Tuskegee model of learning by doing. The prominent Black educator and leader Booker T. Washington (1856-1915) believed African Americans would benefit more from a more vocational education—learning skills and trades. The agricultural and industrial education model was designed by Samuel Chapman Armstrong (1839-1893), the principal of the Hampton Normal and Industrial Institute (now known as Hampton University) in Virginia. Armstrong was a white general in the Union Army during the Civil War and the son of missionaries (Anderson, 1988). Booker T. Washington, a student of Armstrong while at Hampton, brought this model of education to Tuskegee, which he founded and for which he was the first president (Anderson, 1988). This model of education sought to “develop and refine the moral character of African Americans, to prepare students to be teachers and leaders through their own scholarship, and to teach students a manual or industrial trade so that they [would?] be self-supporting and good examples of industry to the people of their own race” (Croom & Alston, 2009, p. 5). However, by 1915 the method of education began to break down at Tuskegee (Anderson, 1988). For example, graduates of education were having difficulties meeting the academic requirements for teaching and state certifications (Anderson, 1988).

W.E.B. Du Bois (1868-1963) believed that African Americans should receive a more liberal arts education - learning mathematics and philosophy. According to Wending (2018), “Du Bois promoted liberal and classical education as the primary means for the Black community to recognize their social power and swiftly bring democracy to the Black community” (p. 288). He felt following a vocational only model would result in African Americans in the south remaining in the lower rungs of American society and in many accounts criticized Washington regarding this (Gasman, 2025). In addition to Washington’s education philosophy he argued against Black

political power and that the focus should be on agricultural and industrial labor (Anderson, 1988; Sanders, 2021). Washington famously said in his 1895 Atlanta Compromise, “Cast your buckets where you are (Washington, 1895)” urging members of all races to start where they are, that it was more important to focus on learning job skills and manual labor, whereas Du Bois and other leaders believed it was very important for African Americans to organize politically (Sanders, 2021). Though they both seemed to have opposing views, they were both influential leaders at the time and made a large impact on the education and lives of African Americans.

The Committee of Twelve, a group of African American leaders including Washington and Du Bois was established in 1903. Their aim was to examine the status of African Americans in this country and develop strategies for advancement (Du Bois & Browne, 1904). It was no secret that Washington and Du Bois held opposing views and Du Bois ended up leaving the group after 4 months. However, another member of the committee was Howard University professor Kelly Miller. Kelly Miller was on track to be the first African American to receive a PhD in mathematics. He enrolled in the PhD program at Johns Hopkins in 1887 and stayed for two years. He eventually had to leave because he did not have the financial means to continue. An alumni of Howard, Miller taught high school before returning to Howard as a faculty member where he remained for the rest of his career. Kelly Miller was a prominent mathematician, sociologist, essayist, and newspaper columnist.

There are two reasons why I bring up Kelly Miller and the Committee of Twelve here. In 1909 Woodard conducted a study on the status of African Americans in Jackson, Mississippi¹. This study was commissioned by this committee. The other reason is to discuss Kelly Miller’s perspective on higher education. He fell somewhere in the middle of Washington and Du Bois. Miller, in agreement with Washington, believed the majority of African Americans needed an

¹ I go into more details about the study in Chapter 4.

industrial education. He frequently traveled to the south and emphasized the importance of African Americans buying and working the land to establish a rural economy for African Americans in the South (Wright, 1978). As stated in Wright's 1978 article on Miller's thoughts and leadership, Miller felt, "it was possible to develop and expand agricultural industries, which would be the key to the race's survival and progress" (p. 183). However, Miller also said in his 1898 speech to the graduating class at Howard University, "mere rudiments of knowledge, practical information of manual cleverness, cannot refine the nature or purify character. They do not reach the soul, but leave the human spirit in the same sad condition in which they find it" (Miller, 1898, as cited in Wright, 1978, p. 184). He then emphasizes the importance of a system that supports "the whole cycle of human experiences and interest cannot but leave the nature purer, the character nobler, and the faculty stronger and better able to perform any task which may be assigned them" (Miller, 1898, as cited in Wright, 1978, p. 184). Miller, in other writings, expressed that one of functions of higher education was for the training of leaders who would disseminate the knowledge they gained to the masses as well as professionals like doctors, lawyers, teachers, preachers and politicians to serve the race. (Wright, 1978; Miller, 1899). This seemed to be a common feeling among the African American leaders of this time including Washington and Du Bois. They all expressed the importance of developing Black leaders and professionals to serve and guide the masses. It seems as if there were opposing views on the function of higher education for African Americans but they all agreed on the development of leaders and professionals (Anderson, 1988; Wright, 1978).

Those who felt African Americans should not have access to education, in particular higher education, worked hard to limit the number of HBCUs, limit access to colleges and universities, and lower or eliminate funding to these institutions. Jones (1917) published an

attack on the quality of HBCUs concluding that the only HBCUs capable of collegiate level study were Howard and Fisk (Anderson, 1988). DuBois added to this, inadvertently, by offering a critique and rating of HBCUs. Du Bois rated schools like Howard University, Fisk University, Atlanta University, Morehouse College and Virginia Union University as first grade, Lincoln, Talladega, Wilberforce as second grade and Lane, Bishop, Miles Memorial as other (Anderson, 1988). The purpose of his critique was an attempt to strengthen HBCUs by focusing efforts and resources into a smaller number of institutions, i.e. first grade institutions (Anderson, 1988). However, Du Bois' report was received by some as an attack on HBCUs.

In this debate Howard fell on the side of liberal education. This conflict is important to understand when thinking about Woodard because of his involvement with HBCUs during this time. He taught at both Howard and Tuskegee and he attended, and taught at, Wilberforce. He earned a PhD in mathematics at a time when people believed African Americans did not need higher education and if so definitely not a liberal arts education. It is clear now that Woodard studied and taught on both sides of this argument.

2.3 Howard University

Howard University, a private HBCU in Washington, DC founded in 1867, has a long history of educating Black doctors, preachers, teachers, nurses, dentists, lawyers, and scientists. The university was founded by Civil War Union General Oliver Otis Howard and offered a liberal arts education from the start. General Howard served as the first president of the university and he served as the commissioner of the Freedmen's Bureau (Logan, 1969). The Freedmen's Bureau was established to meet the basic needs of newly freed slaves following the Civil War with education being among these basic necessities (Gasman, 2025). Though the Freedmen's Bureau only existed for a short time it helped with the establishment of some

HBCUs like Howard University. Howard's development of their professional schools of law, medicine and divinity made them a leading university for African Americans.

Throughout the years, Howard University continued to establish itself as a leading HBCU. The university expanded their offerings, student enrollment, faculty and facilities. A lot of change came under Mordecai Johnson, Howard's first African American President. He was the president of Howard beginning in 1926 until his retirement in 1960 (Drewry & Doermann, 2001; Dyson, 1941). Under Johnson's leadership the university supported the faculty, involving them more in the control and decision making around the University. He did so by developing committees for faculty members to serve on, giving the heads of each department more authority, and raising salaries (Dyson, 1941). In addition to giving faculty a voice within the university, Johnson also gave faculty free will over curriculum (Logan, 1969). Under Johnson's leadership the university greatly increased their volume of scholarly publications (Howard University, 1945). Johnson, as president of the University, was involved in the development of graduate work at the university. He empowered faculty members to contribute to developing graduate studies at the university and within their departments. When the graduate school was established in 1934, Johnson was a member of the Committee on Graduate Studies (Howard University Catalog, 1938). I go into more detail about this committee in Chapter 5. However, it is noteworthy to state that the creation of committees and giving faculty members more power within the university was a part of Johnson's mission. This gave space and freedom to faculty members like Woodard to develop and expand graduate studies at Howard.

2.4 Successful Mathematics Departments for Black Students

As mentioned in the introduction chapter, HBCUs are leaders in producing Black students at the undergrad level who go on to receive PhDs in the STEM fields (STEM: Einaudi

et al., 2022; Cooper, 2004; National Science Foundation, 2008; Shuler et al., 2022; Upton & Tanenbaum, 2014). Researchers have examined this phenomenon to understand the ways in which HBCUs support and prepare their students for advanced degrees. James Donaldson (1989), a long-time Howard professor, examined the practices of successful mathematics departments like Morehouse College under Professor Claude Dansby and Morgan State College under Clarence Stephens among others. He found that in these programs faculty members believed that their students could learn, held high expectations and high standards for their students, helped build student's confidence in themselves and their ability, taught their students with clarity and patience and identified with their students (Donaldson, 1989).

One mathematics department that implemented many of these aspects was the mathematics program at Morgan State College under the leadership of Clarence Stephens. Stephens, a mathematician and educator and the ninth African American to earn a PhD in mathematics, set in place practices at Morgan State College, an HBCU, and later SUNY Potsdam that would become known as the Morgan-Potsdam Miracle. During his time at Morgan State Stephens not only increased the number of mathematics majors, he also prepared and encouraged them to pursue PhDs (Houston, 2018; Walker, 2014). The practices that made Stephen's programs successful in supporting students and preparing them for advanced degrees were ensuring that faculty members were committed to their students' learning and growth and, that faculty members believed in students' ability and willingness to learn mathematics, teaching students to read mathematical texts and think logically about what they read, as well as implementing problem solving into lessons because Stephens felt the best way to understand how to solve a problem was not by watching someone else solve it but by solving a lot problems yourself (Datta, 1993; Houston, 2018; Spencer, 1995). Early student accounts of Stephens

remember him encouraging them to aim for MIT because even if they miss, they would still have a PhD (Walker, 2014).

Other studies like Borum et al. (2016) sought to examine the practices of HBCUs “that support mathematics development, nurture mathematical talent, and disseminate effective practices beyond the walls of these institutions and across generations of students” (p. 1). For this study, the authors interviewed 40 Black mathematicians about their mathematical experiences and from their stories found three key factors that contributed to their success. Their professors at HBCUs were supportive, providing academic and professional support and encouraging them to attend graduate school. They formed strong peer groups that allowed for collaboration and helped with their mathematical development. Lastly, their HBCUs helped cultivate their confidence and ability in mathematics, reinforcing their sense of belonging in a mathematical community (Borum et al., 2016). This study also included an institutional case study of Morgan State College, mentioned above, and Spelman College under the leadership of mathematician Etta Falconer.

Etta Falconer earned a PhD in mathematics in 1969 from Emory University (Falconer, 1969). She was a long time faculty member of Spelman College, an all women’s HBCU founded in 1881. She played an important role in mentoring, not just her students at Spelman but also other faculty and staff members. Her students and other faculty members contributed the success of Spelman in the mathematical sciences to her mentoring and leadership (Borum et al., 2016). Students contributed their success to the supportive environment that exists at Spelman. One participant said, “It was easy to major in math at Spelman, because they’re supportive” (Borum et al., p. 11). Dr. Falconer, in an acceptance speech for the Association of Women Mathematicians Louise Hay Award, said, “I have devoted my entire life to increasing the number

of highly qualified African Americans in mathematics and mathematics-related careers. High expectations, the building of self-confidence, and the creation of a nurturing environment have been essential components for the success of these students” (Falconer, 1995, as cited in Walker, 2017, p. 113). Dr. Falconer’s words echoed her student’s contributing factors to their success.

Morehouse College, Spelman’s neighbor in the Atlanta University Center, where Du Bois and many other Black luminaries taught, is another top HBCU in preparing Black students in the STEM fields for advanced degrees. Like Howard, both Morehouse and Spelman are among the top HBCUs that produce Black PhDs in the STEM fields (Einaudi et al., 2022). One of the prominent professors at Morehouse was Claude B. Dansby. Dansby was a professor at Morehouse for over forty years from 1922 to 1967 and though he himself never pursued a PhD in mathematics a number of his students did (Houston, 2020). The student accounts of Claude Dansby highlight his supportiveness and encouragement to continue excelling in mathematics (Houston, 2020). Colleagues’ accounts of Dansby remember him as an “extraordinarily able teacher” (Blackwell, 2003, p. 17).

Jett (2022) conducted a study on Black male success in high education focusing on the experiences of Black male mathematics students at Morehouse College. In *Black Male Success in Higher Education: How the Mathematical Brotherhood EMPOWERS a Collegiate Community to THRIVE*, Jett examines the experiences of 16 mathematics students at Morehouse and found similar findings among studies done on learning mathematics at HBCUs. Jett found that Morehouse too fostered a supportive, collaborative community among their students and faculty. In addition to this the university contributed to the students confidence and sense of belonging by fostering a supportive environment (Jett, 2020).

Cooper (2000) examined the department in mathematics at The University of Maryland College Park. The University of Maryland is not an HBCU and Cooper's focus was on the graduate program. However, the department was experiencing an increase in the number of African American students enrolling in and completing the program. In 1998 the university had twenty-one Black students in the graduate program in mathematics, many of whom were in the PhD program (Cooper, 2000). In 2000, three Black women mathematicians, Tasha Inniss, Sherry Scott, and Kimberly Weems, made history becoming the first cohort of Black women to earn PhDs in mathematics from the university (Kellogg, 2001). In Cooper's examination he found the following key aspects significant to the success of this program: departmental commitment to all students, Black presence in faculty, students, and staff draws other Black students to a program, academic and social groups are important to student success as well as mentorship before, during and after a student's time in the program (Cooper, 2000). Mathematician and long-term faculty member at the University of Maryland Raymond Johnson, who for many years was the only Black professor in the University of Maryland's mathematics department, played a large role in helping the department increase the number of Black students in the program (Cooper, 2000). In his time as department chair Johnson identified key elements to improve the department's support of Black students: "departmental commitment, social support, informal networks for the transmission of information, and a diverse environment" (Cooper, 2001, p. 182).

In all of these studies on the mathematics department at HBCUs at the undergraduate level and the department of mathematics at the University of Maryland at the graduate level, the key aspects that contribute to the success of developing mathematical talent among Black students are similar and echoed in James Donaldson's findings: HBCUs foster a supportive and collaborative environment for their students, their faculty members provide academic and

professional mentorship for students, and they foster a strong sense of belonging, all contributing to the success of their students and departments.

Chapter 3: Methodology

Historical research is an attempt to understand the past through primary and secondary sources. A historical case study focuses on a specific person or event from the past, using these sources to interpret the details for that person or event (Lune, 2017; Schrag, 2021). As a historical case study, this dissertation's methodology involves using primary and secondary sources to establish the details of Dudley Weldon Woodard's life and career and of the genesis of the graduate program in mathematics at Howard University. When conducting a historical study using historical documents it is important to consider the validity of the documents, to use multiple sources when possible to reduce bias and to place text within the relevant historical context (Kipping et al., 2014). While this study used documents from a variety of sources, the majority of the archival documents come from the archives of Howard University. Most of these documents were published by Howard University and kept for their records. Other sources come from established publications like the *Washington Post* or are official records from an established institution, like the federal or state government. When possible I used multiple sources to verify or confirm information. Though it is impossible to locate every document that would relate to this study, I made an effort to locate as many documents as possible to address this study while also taking into account the gaps in the available information.

3.1 My Introduction to Woodard

My first memory of learning about Dudley Weldon Woodard was in reading Walker's *Beyond Banneker: Black Mathematicians and the Paths to Excellence*. He was mentioned briefly in a larger discussion of Elbert Cox, the first African American to receive a PhD in mathematics. He was mentioned again in a discussion of Howard University's mathematics department. And

he was mentioned a final time noting that he received his bachelor's degree from Wilberforce University, an HBCU.

After my initial introduction to Woodard, I found various short and brief biographies written about him. Some of these include a page on the [Mathematicians of the African Diaspora](#) website, a short article from the University of Pennsylvania on Woodard and his student William Claytor titled [Penn's pioneering mathematicians](#), and a [University of Chicago article](#) about trailblazers from their Physical Sciences Division. These biographies and some others helped me establish a general understanding and timeline of Woodard's life and career. I used the information I gathered to create the timeline detailing the main events in Woodard's life and career. A snapshot of the timeline can be found in Figure 1 (full timeline in Appendix A).

Figure 1: Timeline of Events related to Woodard and of Howard University

1867	1876	1881	1895	1900	1903	1906	1907	1907 - 1914	1917	1914 - 1920	1920	early 1920	1920-1929
Howard University established its Department of Mathematics.	Edward Alexander Bouchet - first african american to earn a PhD. Earned PhD in physics from Yale University	Born on Oct. 3 in Galveston, Texas		Began college at Wilberforce University	Received A.B. from Wilberforce University	B.S. from University of Chicago	M.S. from University of Chicago	Taught at Tuskegee Institute for seven years		Taught at Wilberforce University for six years	Joined the faculty at Howard University	Took advance math course during the summer session at Columbia University	Dean of the College of Arts and Sciences at Howard University Source: https://hdl.handle.net/2027/mdp.39015006964129?urlappend=%3Bseq=95
		Father worked for the U.S. Postal Service		WEB Du Bois taught summer school at Tuskegee				Negro progress in a Mississippi Town published 1909				"During this time he became recognized as one of the gifted mathematicians in the nation"	https://hdl.handle.net/2027/mdp.39015006964129?urlappend=%3Bseq=219

With this timeline in mind I set out to find documents to corroborate these details and fill in any missing blanks. As I learned more, I added to the timeline.

3.2 Searching for Documents

I began by locating documents in digital databases that mentioned Woodard starting with Howard University's digital archives. I used a selection of keywords to locate documents that referenced Woodard. I first searched for Woodard's name in documents using variations of his

full name, Dudley Weldon Woodard. There are a few places where his name is spelled “Woodward” so I included this in my search as well. I used these same keywords when searching other digital archives at the other universities with which Woodard was affiliated, such as Tuskegee Institute, Wilberforce University, The University of Pennsylvania and Columbia University. I used the same keywords when searching city and state archives, including [The District of Columbia Archives](#), [Ohio state archives](#), [The Library of Congress](#). Then I broadened my search by using other keywords and names including, Elbert Cox, Kelly Miller, William Claytor, mathematics, mathematics department, graduate study, graduate committee to locate additional documents relevant for this study, highlighting the graduate program and other faculty and students at Howard. Lastly, I used [ancestry.com](#) to find more personal information about Woodard, like his census records and marriage certificate. On ancestry.com I identified Woodard’s profile using his name, date of birth and place of birth. Woodard’s birth date and place of birth is listed in many short biographies (Brockmeier, 2020; Donaldson, 1989; Houston, 2001; Williams, n.d.) including his *Washington Post* obituary (The Washington Post, 1965) and Curriculum vitae (Woodard, n.d) which was sent to me from the archivist at Howard University, seen in figure 2 and figure 3, respectively (Full CV can be seen in Appendix B).

The Washington Post - July 16, 1965
Dudley W. Woodard, 83;
Former Dean at Howard U.

Dudley Weldon Woodard, 83, former Dean of the College of Liberal Arts at Howard University, died of cancer at his home in Cleveland yesterday.

Mr. Woodard, a professor of mathematics, served as Dean from 1920 to 1929 and as head of the mathematics department from 1944 to 1947. He was professor of mathematics in the intervening years.

Mr. Woodard was born in Galveston, Texas. He graduated from Wilberforce College in Ohio and later received a doctorate from the University of Pennsylvania.

At Howard, Mr. Woodard established the program for graduate study in mathematics. He retired from the University in 1947.

He had a great interest in Spanish culture, and he often visited Mexico.

Survivors include his wife, Gertrude H., a son Dudley H., two grandchildren and three great-grandchildren, all of Cleveland.

Figure 2: Woodard's Washington Post Obituary

Dudley Weldon Woodard

Birth: October 3, 1881
Galveston, Texas

Education:

Elementary-	Galveston, TX		
Secondary-	Galveston, TX	Graduated 1899	
Collegiate-	Wilberforce, Univ.	1900-03	S.B., 1903
	University of Chicago	1906*	S.B., 1906
		1907	
	University of Pennsylvania	1906-07*	S.M., 1907
	University of Pennsylvania		Ph.D., June 1928

* Three summer quarters were spent at the University of Chicago in undergraduate work. Four summer sessions and one full academic year were spent at the University of Pennsylvania.

Title of Master's Thesis: "Loci Connected With the Problem of Two Bodies"

Title of Ph.D. Dissertation: "On Two-Dimensional Analysis Situs with Special Reference to the Jordan Curve-Theorem"

Figure 3: Woodard's Howard University CV

Once I found Woodard's profile I was able to collect documents that helped outline aspects of Woodard's life. In addition to that, I was able to find information about Woodard's family.

Though I was able to find much information using digital archives, I also connected with the archivists at Howard University, the University of Pennsylvania and Columbia University. These archivists helped me locate additional documents related to this study that have not been added to the digital archives. In addition to this I reached out to the registrar at the universities Woodard was said to attend to confirm his attendance and verify the exact years. Doing so addresses my first research question in confirming the details of Woodard's higher education.

3.3 Types of Documents

Governmental records

This category of documents includes, for example, census records, registration cards, passport documents, marriage records. These documents were used to establish and verify basic facts about Woodard's life, answering research question 1 which addresses what is known about Woodard's life and career. These documents helped me identify and verify birth dates, employment, residency, and family members. For example, census records corroborate Woodard's residency, employment status, and titles with other accounts of Woodard's employment and education.

Newspapers

For this study I searched local city and federal archives for information referencing Woodard and the graduate program in mathematics at Howard. I was able to locate articles from newspapers like the *Washington Tribune* that were relevant to this project. For example, I found an article outlining a lecture Woodard was to give on Einstein's theory of relativity in multiple local newspapers like the *Broad Ax* and the *Dallas Express*. This article helps to address research

question 1, more specifically highlighting aspects of Woodard's career as a mathematician and mathematics educator. This source also addresses research question 2 and 3, speaking to the programming Woodard was involved in and possibly implemented as an administrator and educator in Howard's mathematics department.

Publications

While at Tuskegee, Woodard authored a textbooks titled *Practical Arithmetic* (1911), a study on teaching geometry titled *The Teaching of Geometry at Tuskegee* (1913), and a study on the conditions in Jackson Mississippi titled *Negro progress in a Mississippi town, being a study of conditions in Jackson, Mississippi* (1909). Woodard also published two research papers on plane topology, *On two dimensional analysis situs with special reference to the Jordan Curve Theorem*, in *Fundamenta Mathematicae* in 1929 and *The characterization of the closed N-cell* in *Transactions of the American Mathematics Society* in 1937. These sources address research question 1 by highlighting accomplishments in Woodard's career as both a mathematician and mathematics educator.

3.4 Howard University Sources

The Hilltop: Howard University Student Newspaper

The Hilltop is Howard University's student newspaper which was established in 1924. This student led newspaper covered a range of topics from campus activities to national and international current events. Digital copies of the Hilltop can be found in Howard University's digital archives dating back to its founding year. I used keywords like Woodard, mathematics, graduate study to locate issues of this newspaper that were relevant to this project. My search expanded to include other keywords as I learned more about Woodard and the mathematics department at Howard.

These documents helped establish information like employment updates, student clubs, information about Woodard's wife and son, information about Woodard's students, and even anecdotes from Woodard himself. For example, there is a *Hilltop* article announcing the appointment of Elbert Cox to the mathematics department (figure 4). Another example is a *Hilltop* article about the mathematics society for which Woodard served as the faculty advisor (figure 5). This article conveyed Woodard's pride in the students he worked with as a part of the club, addressing research question 3 regarding Woodard's mentorship of students at Howard. Other articles from the *Hilltop*, like one outlining the history of graduate study at the University, addressed research questions 2 and 3, presenting main details of the graduate program at Howard.

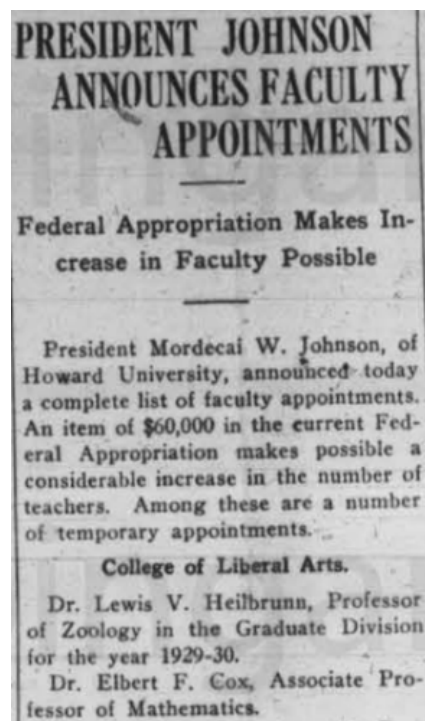


Figure 4. Excerpt from *The Hilltop* announcing Elbert Cox's appointment among many others.

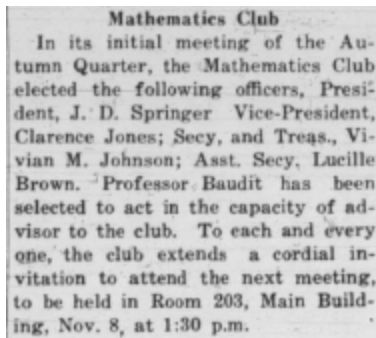


Figure 5. Excerpt from the Hilltop highlight details of the Mathematics Club at Howard.

Yearbooks, Commencement Programs

Howard University's yearbooks and commencement programs dating back to 1870 can be found in the university's digital archives. I reviewed the commencement programs from 1920 to 1945, the years Woodard worked at Howard, to find the students who received a degree in mathematics to establish a list of students of Woodard and other members of the mathematics faculty. I reviewed yearbooks from the same span of years. I used keywords like Woodard, mathematics, names of known students to find information relevant to this project. I was able to establish Woodard's leadership positions, clubs and student organizations, and a list of students who majored in mathematics during this time. These yearbooks helped me address the first research question in highlighting information about Woodard's leadership positions at Howard as well as the social groups he was a part of. Both the yearbooks and commencement programs helped me begin to establish a list of students in the mathematics department during Woodard's time at Howard.

It is important to note that being listed in the commencement program does not guarantee a degree was granted. However, it still gives us an idea of who may have been students of Woodard and other members of the math faculty.

Howard University Course Catalogs

I reviewed Howard University's course catalogs from 1920 to 1945. I chose this time frame because it overlapped with Woodard's time at Howard and the start of the graduate program in mathematics. Howard University publishes a comprehensive Annual Catalog every year. These catalogs not only communicated the necessary university information like available courses, degree requirements, and fees, but it also included lists of students, faculty, members of university committees and much more. These catalogs outlined the requirements for a bachelors and masters in mathematics and showed how these requirements evolved over time. They also helped verify the faculty in the mathematics department and the courses they taught as well as the students from the department. These catalogs were used to show the transition the department went through from only offering a bachelors to also offering a masters in mathematics addressing research question 2.

Howard University Publications

The Howard Review is a scholarly journal published by Howard University for which Woodard served as the Editor-in-chief. *The Howard University Journal* was a weekly publication detailing the relaying important university updates to students, faculty and staff. *The Howard University Record* was a magazine released four times a year highlighting the life and work of students, alumni, faculty and staff. These are all sources that Woodard worked on or edited himself and these documents were used to highlight the work Woodard did as a mathematician,

mathematics educator and as a leader at Howard, contributing data to address research questions 1, 2 and 3.

3.5 Analysis of Documents

To analyze the documents described above I used content analysis, examining each document, analyzing the content and context, and organizing the documents based on their relevance to each research question (Mackieson et al., 2019; Danto, 2008). In addition I used elements of visual timeline analysis by creating a timeline of the major events in Woodard’s life to help visualize the story told by the documents (Baú, 2024); and social network analysis, creating charts and lists to visualize and understand Woodard’s relationships with students, faculty and Howard University (Scott, 2012). To keep track of the documents used in this study I organized them into a google sheet. A snapshot of this can be seen in figure 6.

	A	B	C	D	E	G	H	I	J
1	Title	Date	Description	Where I received document	Notes	Type of document	Citations	Thoughts/Key words	Research Question
14	The evening star: Dr. E. P. Davis Dies: Dean at Howard	February 14, 1938	Dr. Davis served as acting dean of the College of Liberal Arts during the academic year 1927-1928, while Dean Dudley Weldon Woodard was on leave of absence.		Woodard took this time to finish his dissertation			education	1
15	The Evening Star: 26 Get Degrees at Howard U.	June 9, 1928	Woodard's son appears in newspaper					Family	1
16	The Evening Star: Miner College Dean to Retire Tomorrow	October 30, 1947	Woodard's wife retires from Miner College. The article also mentions Woodard and his retirement from Howard the year before.					family, career	1
17	Evening star: birth record	June 28, 1935	Birth record - grandson		Birth of grandson maybe? Dudley and Ora Woodard (daughter in law), boy			family	1
18	The Evening Star: Colored Net player Reach Semifinals	August 11, 1939	Dudley Woodard son					family	1
19	The Hilltop 1-13-1950	January, 13 1950	Son listed as member of National Technical Association	Howard Digital Archives				family	1
20	The hilltop 1-26-1949	January, 26 1949	David Blackwell presented a paper entitled "Statistical Concepts in an Infinite Number of Dimensions" at the ASA annual meeting	Howard Digital Archives				other faculty at Howard	2,3

Figure 6. Snapshot of document organization google sheet

For each document I noted the title, date, a brief description, where I obtained the document, notes on the relevant information in the document, type of document, citation, and thoughts/keywords. Then I assigned a 1, 2, and/or 3 to each document, noting which research

question the document addressed. With each document organized by research question and timeline, I began outlining the story of Woodard and the graduate program in mathematics at Howard University.

Chapter 4: A Brief Biography of Dudley Weldon Woodard

This chapter will examine the details of Dudley Weldon Woodard's life and career, beginning with what is known about his family and early life growing up in Galveston, Texas. Very little information is known about Woodard's early life and family. However, below is a narrative compiled using census records, birth and death records, and marriage records making note of the gaps and missing information in this story. This chapter will also give an overview of Woodard's educational background outlining the schools he attended and the degrees he received. Lastly, this chapter will outline Woodard's career as a mathematician and mathematics professor at various HBCUs. During Woodard's career he wrote publications, mentored students and took on leadership roles at the Universities where he worked.

4.1 Early Life and Family Background

Very little is known about Dudley Weldon Woodard's early life. What I discovered was pieced together using government documents like census records, birth records and marriage records, and newspapers. I used the information discovered to create a family tree outlining Woodard's family. This family tree can be found in figure 7.

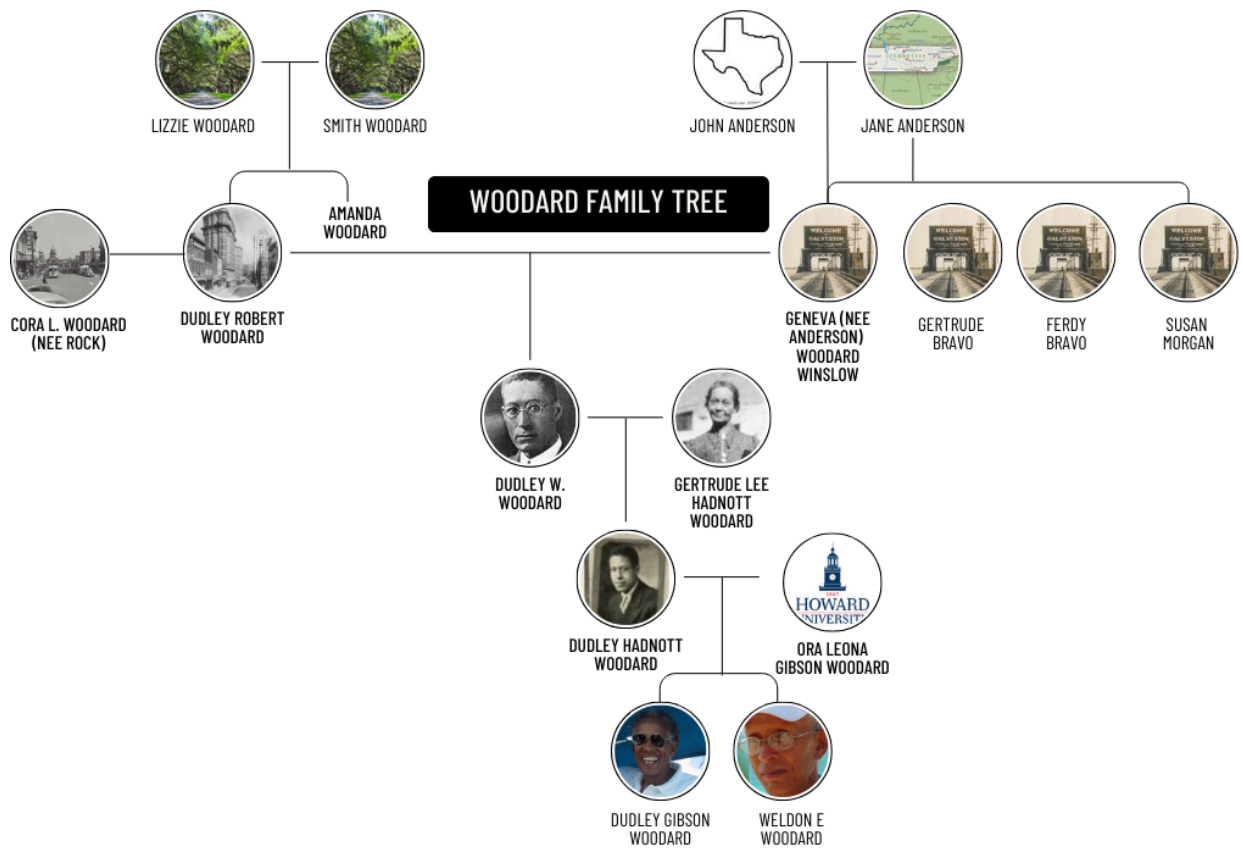


Figure 7. Woodard Family Tree

Woodard was born on October 3, 1881 to Dudley R. Woodard and Geneva (spelled Genevina in some places) Woodard (née Anderson) in Galveston, Texas (United States Bureau of the Census, 1900). Dudley R. and Geneva were married on March 8, 1881 (Texas Galveston County Clerks Office, 1881), 7 months before their only son, Dudley Weldon Woodard was born.

Dudley R. Woodard, Woodard’s Father

Dudley R. was born in Atlanta, Georgia in 1858 and was the son of a farmer (United States Bureau of the Census 1870; United States Department of Commerce and Labor Bureau of the Census, 1885). He worked as a clerk for the United States Post Office (United States Bureau of the Census, 1900). Gathered from Dudley R.'s death certificate (Texas Bureau of Vital Statistics, 1943) and a published list of all federal employees (United States Department of

Commerce and Labor Bureau of the Census, 1885), Dudley R. moved to Austin, Texas around 1885, when his son was 4 years old, and continued to work at the Post Office until he retired. In 1896 he married his second wife Cora L. who was a school teacher (United States Bureau of the Census, 1900; United States Bureau of the Census, 1930). Though not much is known about their education, the 1940 census shows Dudley R. completed at least one year of college (United States Bureau of the Census, 1940). A Dudley R Woodard appears in an 1876 Atlanta University list of students attending the normal school (Atlanta University, 1876). However, this is a single source and there is no additional information, like birth date or address, to help verify that this Dudley R. is Woodard's father. He died on December 30, 1943 in Austin, Texas (Texas Bureau of Vital Statistics, 1943) and his wife died on February 15, 1951 in San Antonio, Texas (Texas Department of State Health Services, 1951). They had no additional children. In a biography of Woodard on the math history website mathshistory.st-andrews.ac.uk Dudley R. is said to have had another wife Lulu Worthy. There is another Dudley Woodard born around 1876 in Georgia who married a Lulu Worthy in 1893 (The Georgia Archives, 1893). Though I'm not certain, it is possible that both Dudley's are relatives. They were both born in Georgia a few years apart and Dudley is a common name in Woodard's family.

Geneva (née Anderson), Woodard's Mother

Woodard's mother, Geneva was born in Galveston, Texas in 1865 (United States Bureau of the Census, 1880). Her mother, Jane Anderson, was born in Tennessee and worked as a housekeeper (United States Bureau of the Census, 1880). Jane had three other children, daughters Gertrude Bravo and Susan Morgan (née Brown) and son Ferdy Bravo. According to Geneva's death certificate her father was a Texas born man named John Anderson (Texas Bureau of Vital Statistics, 1919), though he does not appear in any census records with Geneva. In a

1880 census Jane Anderson is listed as a widower (United States Bureau of the Census, 1880). In several census records Geneva and her mother Jane are categorized as mulatto (United States Bureau of the Census, 1880). (In some records Woodard, his wife and son are also listed as mulatto but listed as black in others). According to the 1880 census, fifteen year old Geneva lived at 218 29th St with her mother, Jane Anderson, siblings Susan, Gerty (Gertrude) and Ferdy, and cousins/children of older sister Susan (United States Bureau of the Census, 1880). In a 1917 *Gazette News-Current* of Xenia, Ohio article outlining the goings on around Wilberforce, there is a mention of Woodard's mother spending the winter with him and his family (*Gazette News-Current*, 1917b). Her name in this article is Mrs. Geneva Winslow, indicating that possibly she remarried in addition to changing her last name to Winslow. Given this information, I was able to find a death certificate for Woodard's mother. She died on July 20, 1919 at 49 years old (Texas Bureau of Vital Statistics, 1919). The certificate is signed by Geneva's sister Gertrude Bravo. Though I was unable to find a divorce record between Woodard's parents, Dudley R. and Geneva, I assume they divorced before each remarrying. Based on the 1900 census, eighteen year old Woodard was living at 912 29th Street with his aunts, Gertrude and Susan, and cousins. He was working at the Post office (United States Bureau of the Census, 1900). This is just before Woodard left Texas to begin college at Wilberforce University. This plus his father's Austin residency and his Aunt Gertrude being listed as his guardian on his University of Chicago Transcript suggests Woodard was actually raised by his aunts, in particular his Aunt Gertrude, which was confirmed by Woodard's grandson, Weldon Woodard, after recalling their conversations together.

Wife and Son

Woodard married Gertrude Lee Hadnott on August 4th, 1908 in Birmingham, Alabama (Alabama County Marriage Records, 1908). Mrs. Woodard was born in Alabama in 1883 (United State, Bureau of the Census, 1910) so it is possible they met during the time Woodard was a professor at the Tuskegee Institute. Mrs. Woodard was an educator as well. She was a teacher and eventually the assistant principal and dean at Miner Teachers College in Washington, DC (District of Columbia Board of Commissioners, 1925; *The Evening Star*, 1947). They had one son, Dudley Hadnott Woodard, born on June 29th, 1909 (United States Bureau of the Census, 1910). Dudley H. attended Howard University (Howard University, 1928a; *The Evening Star*, 1928) and studied physics. He was a part of the ROTC (Hilltop Staff, 1927; *The Evening Star*, 1928) at Howard. He followed in his parents footsteps, having worked at both Miner Teachers College as a teacher ([Dudley H. Woodard WWII Draft Registration], 1947) and he was a faculty member at Howard in the Engineering and Agriculture department (*The Bison*, 1949; Howard University, 1950). In addition to this he was a member of The National Technical Association, an organization created to support Black Technicians and Engineers and worked at the U.S. Bureau of Standards as a Physicist (Hilltop Staff, 1950).

While Woodard lived with his family in Washington, D.C., they owned a home on W Street (United States Bureau of the Census, 1930; United States Bureau of the Census, 1940). This house, located in the Bloomingdale neighborhood, was at the time considered a white neighborhood and the neighbors were not happy when Woodard and two other Black families bought homes on this block. According to a 1923 *Evening Star* article, a march of more than 500 white neighbors in Bloomingdale on the homes of the three Black neighbors was stopped by the police (*The Evening Star*, 1923). The neighbors were happy to help these residents find other homes but they did not want to live next to them. Woodard and his family did not leave the

neighborhood after this incident. According to census data, they lived in this house until Woodard and his wife retired and relocated to Ohio in 1947.

4.2 Education

High School

During Woodard's childhood there were only two public high schools in Galveston, Texas. There was Ball High School which admitted the white children of Galveston and Central High School which admitted the Black students. Central High School was established in 1885 and was the only school for colored students in Galveston. On Woodard's University of Chicago transcript Galveston H.S. is listed as a previous institution, though there was no high school with this name. The transcript states Woodard graduated from high school in 1899. An October 1904 Galveston Daily News article titled *Central High School Alumni*, states D. W. Woodard was elected as the president of Central High School Alumni Association in October of 1904 (The Galveston Daily News, 1904b). This article confirms Woodard attended Central High School and his graduation year of 1899. A month earlier in September of 1904, there was a Galveston Daily News article listing the teaching assignments at the public schools in Galveston, TX. Under the Colored Schools Grammar School Department Woodard is listed as the seventh grade teacher (The Galveston Daily News, 1904a). This overlaps with the time Woodard was a student at the University of Chicago. However, he attended college during the summer of 1904 and 1905 (University of Chicago, n.d.a), leaving time to teach public school in his hometown of Galveston, Texas.

College

Woodard began college at Wilberforce University, a historically black university founded in 1856, in Wilberforce, Ohio in 1900. He received a bachelors of science in mathematics in

1903 from the physical science department (Woodard, n.d.; University of Chicago, n.d.a; Wilberforce University, 1903). According to three separate newspaper articles outlining Wilberforce's 40th commencement activities in 1903, there were a total of 41 graduates and Woodard gave the valedictory speech titled "The Spirit of Inquiry (The Dayton Herald, 1903; The Cincinnati Enquirer, 1903; Gazette News-Current, 1903)." This article can be seen in figure 8.



Figure 8. The Daily Herald, Commencement Week at Wilberforce

Interestingly, Kelly Miller gave the annual address to alumni this year (The Dayton Herald, 1903; Gazette News-Current, 1903). It is likely that Woodard and Miller met many years before Woodard joined the faculty at Howard University where Miller spent his entire career.

Next, Woodard attended the University of Chicago beginning in the summer of 1904 to the summer of 1907. He received another bachelor's of science degree in December of 1906 before transferring to the graduate school in the beginning of 1907. He spent the rest of that year

completing the requirements for a masters of science, which he received in the summer of 1907. His master's thesis in the field of topology was titled “On Certain Loci Connected with the Problem of Two Bodies.” According to his transcript Woodard took additional graduate mathematics courses during the Summer Term in 1921. I have read in many places that Woodard took graduate courses during the summer of 1920 at Columbia University. However, Columbia’s registrar was unable to locate Woodard in their records.

PhD Studies

Once Woodard completed his master’s degree in mathematics he began working as a professor. Many years later after establishing himself as a professor, scholar, and leader within the HBCUs where he taught, including his alma mater Wilberforce University, and seven years into his career at Howard University, he returned to school once more to pursue a doctorate in mathematics. When he began his PhD journey at the University of Pennsylvania, only one African American had received a PhD in mathematics. That was Elbert Cox who in 1925 received a PhD in mathematics from Indiana University (Donaldson, & Fleming, 2000). According to the registrar at the University of Pennsylvania, Woodard attended during 1922-1925 and 1927-1928. It is likely Woodard took summer classes during 1922-1925. He took scholarly leave from Howard in 1927 to complete his dissertation (Woodard, n.d; *The Evening Star*, 1938; *The Washington Tribune*, 1928). Working under advisor John R. Kline, Woodard received his PhD in mathematics with a dissertation titled “On Two-Dimensional Analysis of Situs with Special Reference to the Jordan Curve Theorem (Woodard, n.d; Woodard, 1928)” in 1928 becoming the second African American to receive a PhD and only the 38th person to receive a PhD from the University of Pennsylvania (Penn Archives, 2020). This is when

Woodard returned to Howard University, eventually launching the graduate program in mathematics.

4.3 Early Career

Tuskegee Institute

Woodard was a professor in mathematics at Tuskegee from 1907 to 1914. During this time he served as the Head of the Division of Mathematics (Woodard, 1911). He wrote a textbook titled *Practical Arithmetic* in 1911. He completed two studies, *Negro progress in a Mississippi town, being a study of conditions in Jackson, Mississippi* (1909) and *The Teaching of Geometry at Tuskegee* (1913).

Practical Arithmetic

Practical Arithmetic is a Tuskegee Institute Edition textbook written by Woodard in 1911 while he was serving as the Head of Division of Mathematics at Tuskegee. With this text Woodard added to the mission of Tuskegee Institute “to connect arithmetic in a vital manner with the everyday interests and exercises of the students (Woodard, 1911).” As mentioned in the previous chapter, Tuskegee enforced a more ‘practical’ education approach focusing on learning by doing. Woodard adds to this mission with the textbook by centering problems which were created in collaboration with the other departments at Tuskegee and requires students and teachers to gather the necessary data. In the preface of the text Woodard writes, “It is impossible to carry out the purpose of this book within the narrow confines of the class room (Woodard, 1911).” For example, in the first unit in this textbook focused on understanding numbers and units, the first exercises (seen in figure) require students to go to the Institute’s Dairy Barn to find out units they use for measuring the amount of milk handled daily.

1. Find out what units are used at the Institute Dairy Barn in stating the amount of milk given by a cow in a day.

Figure 9. *Practical Arithmetic, Exercise 1, p.g. 8*

A later exercise (seen in Figure 10) then asks the students to calculate the amount of gallons of milk the Dairy Barn handles in a month.

1. During the month of March, 1911, the Creamery received from the Institute Dairy Barn 6574 gallons of milk and purchased from neighboring farmers 1674 gallons of milk. How many gallons of milk were handled at the Creamery during this month?

6574 gal. Adding: $4 + 4 = 8$; put down 8; 7 tens + 7 tens =
 1674 gal. 14 tens; 14 tens = 1 hundred + 4 tens; put down 4 in
 8248 gal. tens' place of result; 6 hundreds + 5 hundreds +
 1 hundred = 12 hundreds; 12 hundreds + 1 thousand = 2 hundreds;
 put down 2 in hundreds' place of the result; 1 thousand + 6 thou-
 sands + 1 thousand = 8 thousands; put down 8 in the thousands' place
 of the result.

Then, the total number of gallons of milk handled at the Creamery during March, 1911, was 8248.

Figure 10. *Practical Arithmetic, Exercise 6, p.g. 14*

In other problems Woodard continues to use information about the institute and requires the students to engage with other departments while learning the concepts of arithmetic.

This textbook gives us some insight into Woodard's thoughts about teaching and learning. It is unsurprising that what he writes is in alignment with the philosophy of the institution that employs him. It is interesting to see how and if these views evolve as he moves on to other universities and continues his own education journey.

Negro progress in a Mississippi town

Negro progress in a Mississippi town is a study commissioned by the Committee of Twelve for the Advancement of the Interests of the Negro Race. In a letter from Booker T. Washington, the chairman of the committee, to Hugh M. Browne, the secretary, Washington expresses the importance of examining the progress of Negroes in the south and suggests taking a look at a specific town, Jackson, Mississippi (Washington, 1908; Chesnutt; 2002). Washington informs Browne of Woodard's willingness to do the study and asks Browne to communicate these ideas with the rest of the committee. Washington suggested Woodard add the following questions: "To what extent does the Negro pay the cost of his own education?" (Washington, 1908, p. 1).

Jackson, Mississippi is the capital city of Mississippi. In 1909, when this study was done, the population of Jackson was growing rapidly, having gone from 7,810 in 1900 to 21,262 by 1910 (United States. Bureau of the Census. 1910). Employment opportunities for the population of Jackson were on the rise with the large lumber and cottonseed oil mills located in the city. The city also began to build railroads and buildings for commercial use like department stores (Woodard, 1909). It seemed natural to Booker T. Washington to examine this city to get an understanding of the progress of Blacks in the south.

In the study Woodard examined the conditions concerning the Black population in Jackson, Mississippi, focusing on living, working and economic conditions. He found that in the twelve years prior, African Americans in Jackson were earning money and saving and investing that money. Many of them owned their homes or were saving to build their own homes and they owned successful businesses in the town. Woodard did not address the progress of education in this town in the study. The subject matter in this study was different from the other work

Woodard published which was more related to mathematics and mathematics education.

However, it shows Woodard's versatility and willingness to step outside of his role as professor into other leadership positions within higher education and beyond.

Teaching Geometry at Tuskegee

Teaching Geometry at Tuskegee is a study on how students learn geometry at Tuskegee and examines the learning processes of Tuskegee. In this study Woodard outlines the structure of learning at Tuskegee. Students would alternate between "academic" days and "trade" days meaning they spent time in classes as well as engaging in industrial work. Woodard describes an incident of a carpenter student encountering an obstacle while working on a project. This student was charged with laying molding for a new building on Tuskegee's campus. The student was successful laying the molding until he encountered a part of the building that was not at a right angle. The student used brute force to address the corner before posing the question in class the following day. Together with their professor and classmates, this student works through several solutions until they reach one that is the most efficient. Woodard points out the usefulness of working with others on practical examples but he also points out in this instance, instruction time was taken over by this problem. He suggests assigning students into smaller groups based on practical interest and having that group be the space for students to bring up practical questions and work through solutions before bringing the problem to the larger group. This way students have a chance to work together on problems without interrupting instruction time. At the end of the study Woodard emphasizes five key things: the importance of having students work together in small groups outside of class to promote collaboration while preserving instruction time, giving students the chance to create their own problems that are relevant to their work, in this way they start with a specific problem and develop it into or connect it with an abstract idea,

giving students a theoretical and practical understanding of their trade, and lastly the work is engaging and enjoyable for both teacher and students (Woodard, 1913).

Student's account of Woodard as found in Yearbook

The Carver, also referred to as the Onyx Gazette, is the student yearbook at the Tuskegee Institute. The 1914 edition of the Carver was the first one produced entirely by the students. In this 1914 yearbook, which happened to coincide with Woodard's last year at Tuskegee, Woodard was referenced twice: once in the class poem which made reference to all professors at Tuskegee,

“The Woodard city lay in our route
We entered with sore regret;
It's quadratics simple and yet hard,
We haven't seen them yet.” (Tuskegee Institute, p. 7)

The second reference was the quote, “You've flunked. Move out” (Tuskegee Institute, p. 17). Based on these two references it seems as if Woodard was a tough teacher who challenged his students but was also well respected by the students.

Wilberforce

After teaching at Tuskegee for seven years, Woodard joined the mathematics faculty at his alma mater Wilberforce University, where he taught for the next six years. In an announcement of Woodard's appointment to the faculty at Wilberforce, Woodard's addition to the mathematics department is described as “placing the work of the University on a very high level” (Wilberforce University, 1916, p. 13). Woodard continued his practice of serving in leadership positions at the University. He was the chair of the mathematics department (Wilberforce University, 1916). He managed a Research Club, which was described as “doing

much to raise the intellectual standard and stimulate the Faculties to original work” (Wilberforce University, 1916, p. 23). In addition to these leadership positions during the summer of 1914 Woodard taught for Wilberforce’s summer session. He taught alongside many notable intellectuals of that time including W.E.B. Du Bois, who gave an economics lecture (The Cleveland Gazette, 1914). Woodard served on a Wilberforce committee that, in conjunction with the colored branch of the Red Cross, organized a parade to send off the colored soldiers of their county (Gazette News-Current, 1917a). In 1915 when Booker T. Washington passed away, members of Wilberforce University paid tribute to him. Woodard, among many others, who previously worked with Washington at Tuskegee, eulogized him (Gazette News-Current, 1915).

Though Woodard was on the faculty at Wilberforce for only six years, he made an impact during his time there and stayed connected with the university even after leaving for Howard University. For example, Woodard was present at Wilberforce on November 23, 1933 (at this time he was still a faculty member at Howard) when President Roosevelt signed Wilberforce’s Book of a Million Names (The Northwest Enterprise, 1933). In addition, some of Woodard’s students in the master’s program either came from Wilberforce or went on to work there. I discuss this further in Chapter 5.

4.4 Howard University

After teaching at his alma mater for six years, Woodard joined the faculty at Howard University in 1920. He was appointed Dean of the School of Liberal Arts this same year. This came after a dispute between then dean, Carter G. Woodson² and the university president James Durkee. When Woodson, who served as Dean of the School of Liberal Arts beginning in 1916 and the Head of the Graduate Faculty from 1919-1920, was terminated, Woodard took over as

² Carter G. Woodson (1875-1950), known as the “Father of Black History,” was a historian, author, and educator. Woodson and Woodard overlapped a few times in their professional careers. They both attended the University of Chicago and both were professors at Howard University.

Dean of the School of Liberal Arts (Logan, 1969). He also served as the chairman of the Committee of Graduate Study (Dyson, 1941). “During 1920-1921, teaching fellowships were established and graduate study under a second standing committee’s direction took on new life. Dudley W. Woodard, professor of mathematics and dean of the College of Liberal Arts, was the leading spirit in these endeavors. The beginning of graduate work in course at Howard University is indebted to his interest and effort” (Dyson, 1941, p. 182). In addition to being very instrumental in the start of graduate work, Woodard served in other leadership positions including being the faculty supervisor of the Mathematics Society (Hilltop Staff, 1924), the editor of the scholarly magazine *The Howard Review* (Woodard, 1923; Howard University, 1926), a member of the university council committee, the curriculum committee (Howard University, 1931), the rating committee (Logan, 1969). The rating committee was established to give recommendations on whether a member of the faculty should be promoted from Associate Professor to Professor. Woodard was also a member of the board of examiners which was the board in charge of entrance exams for incoming students (Howard University, 1919b).

4.5 Retirement

Woodard retired from Howard University in 1947 (Dudley W. Woodard, 83, 1965). This same year one of his most promising students, William Schieffelin Claytor joined the faculty at Howard (Howard University, 1948). Woodard’s wife, Gertude, also retired this year from her position as Dean of Students at Miner Teacher College after 26 years (The Evening Star, 1947). They moved back to Ohio, where they lived until Woodard’s death on July 1st 1965. Woodard and his wife would visit Mexico often. An Evening Star article announcing Mrs. Woodard’s retirement states that the couple will spend the next six months in Mexico (The Evening Star, 1947). I was able to find travel records of them returning to the United States from Mexico many

times ([Dudley Weldon Woodard Passenger Manifest], 1958). The same article announcing Mrs. Woodard's retirement says they will be moving back to Chicago; however, they lived in Ohio until Woodard's death.

4.6 Other Publications

In addition to publishing a textbook and two studies, Woodard also published two scientific papers. He was the first African American Mathematician to do so. His first research paper titled *On two dimensional analysis situs with special reference to the Jordan Curve Theorem* was published in 1929 in *Fundamenta Mathematicae* (Woodard, 1928). His second research paper, *The characterization of the closed N-cell* in *Transactions of the American Mathematics Society*, was published in *Transactions of the American Mathematical Society* in 1939 (Woodard, 1939). Both of these papers were published in the later part of his career after receiving the PhD. As mentioned above Woodard took on many leadership positions at Howard in addition to having a heavy teaching load and mentoring students. This took away time for his own mathematical research. However, it is still very impressive that he was able to publish these two research papers in addition to his earlier publications.

4.7 Professional Organizations

During Woodard's career he joined professional mathematical associations, including The American Mathematical Society, the Mathematical Association of America and the American Association of University Professors (Woodard, n.d; Nkwanta & Barber, 2015; Richardson, 1922). Woodard passed away four years before the founding of the National Association of Mathematicians (NAM)³. This association was founded to center and include mathematicians of color who, while not officially excluded from membership of the other mathematical

³ The National Association of Mathematicians was founded in 1969.

associations, were discouraged from attending conferences and meetings in southern, segregated states. Eventually NAM would establish the Woodard-Claytor lecture in honor of Woodard and his student William Schienffelin Claytor.

Chapter 5: Howard's Graduate Program in Mathematics and Woodard's Influence

This chapter will give an overview of the development of graduate work at Howard University beginning at the university's founding in 1867 until the establishment of the Graduate School as its own entity within the university. In addition to professional degrees, non-professional advanced degrees had been a topic of discussion since the founding of Howard University, although it took many years to formalize and expand graduate work. This chapter also outlines details on some of the first students to receive master's degrees from Howard, with an emphasis on the students who received their master's degrees in mathematics.

5.1 Graduate Study

The idea of graduate studies at Howard was discussed as early as 1867. Requirements for a 'second degree' were outlined in by-laws by the Board of Trustees of the university (see figure11) (Dyson, 1941).

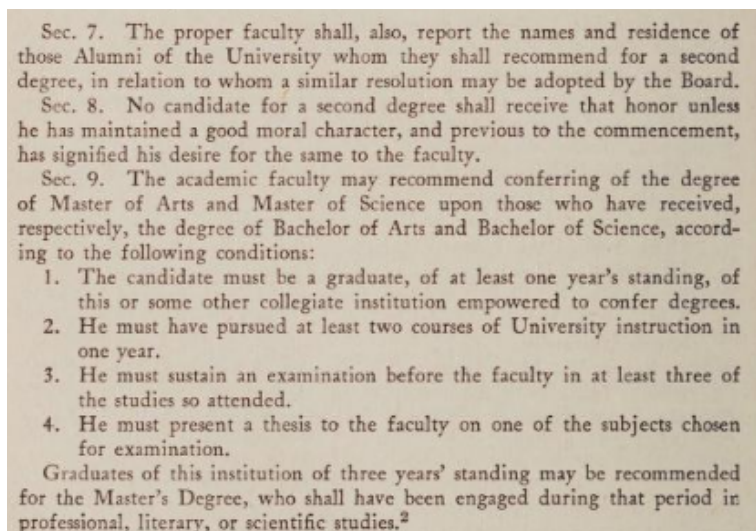


Figure 11: Guidelines for 'second degree' according to 1867 by-laws of the Board of Trustees

These second degrees were granted on a case by case basis to students who had completed one year of advanced study beyond the bachelor's degree and completed a sufficient thesis (Hilltop Staff, 1936). The University also occasionally awarded honorary degrees, including master's degrees. According to Dyson it was not until the 1889-90 school year that guidelines were formalized and published in Howard University's annual catalog (see figure 12).

THE SECOND DEGREE.

The degree of Master of Arts may be conferred upon those who have pursued at least three years of literary or professional study after taking the degree of A. B., and who present a satisfactory "essay or thesis on a subject previously designated by the Faculty." Graduates who intend to take this higher degree should usually make application one year in advance, giving a sketch of their occupation since graduation, the line of study in which they are most interested, and any subject for a thesis which they may think appropriate. It is not the intention to limit the range of study or investigation, but to secure some definite and creditable work.

Figure 12. Excerpt from 1889-90 Catalog describing requirements for the master's degree

According to these guidelines master's degrees were awarded to alumni with at least three years of professional studies after receiving a bachelor's degree in addition to having completed a thesis in their field of study (Howard University, 1889). Between 1878-1898, Howard granted 13 master's degrees (Hilltop Staff, 1936). Of these 13 students granted a masters degree during this time frame I was able to locate three of them in a 1897 Washington Times newspaper article (The Times, 1897) and cross reference them in an Alumni Directory published by Howard University (Howard University, 1919a). These three students were James H. N. Waring, a supervising principal of Washington public schools, Rev. D. E. Wiseman, and Major George H. Harries, president of the Metropolitan Railroad in 1897 (The Times, 1897). Wiseman's master's was in theology while the others were not specified (Howard University,

1919a). More of these students were recorded in Dyson's (1941) comprehensive history of Howard's first one hundred years and confirmed in an Alumni Directory. They were Rooks Turner who received a master's degree in education in 1890, William V. Tunnell⁴, William H. Hart⁵, and Frazier Miller who received their master's degrees in theology in 1891, 1892 and 1893 respectively, and Reverend Mark Thompson who received an honorary master's degree in education in 1899 (Dyson, 1941; Howard University, 1919a). During this time there would be newspaper articles listing the graduates of universities like Howard University and other schools like Wilberforce University. Eventually Howard University would begin printing the names and degrees of student's in their commencement programs and course catalogs but they did not do so during these early years. Thus as the years moved on there became more clear documentation of the university's graduates.

The next updated requirements for the master's degree appeared in the 1904-05 Catalog (see figure 13)

⁴ William V. Tunnell would go on to become a Professor of History at Howard (Howard University, 1907). He served on the Board of Trustees and other committees at Howard for many years (Howard University, 1904).

⁵ William H. Hart also received a masters in law in 1894 and became a professor of Law at Howard (Howard University, 1919a)

THE SECOND DEGREE.

Graduates of the College of Arts and Sciences of Howard University, or graduates of other institutions whose undergraduate course is equivalent to that required for the degree B. A. or B. S. in Howard University, may on approval by the faculty be enrolled as candidates for the Master's degree. The requirements for the degrees of M. A. and M. S. are as follows:—

- (1) At least one year's resident work at this University.
- (2) The selection of a course of study of a homogeneous character and with a definite aim. The work may be done in any department of the University, provided that none of the studies is being offered for any other degree, and that at least half the time is spent at the College of Arts and Sciences in advanced work along some one line.
- (3) A satisfactory examination on the subject or subjects taken for the degree.
- (4) The presentation, not later than May 1st, of two typewritten or printed copies of a satisfactory dissertation on a subject approved by the faculty.
- (5) The payment of a tuition fee of \$25.00 per annum, with \$10.00 additional for diploma.

Figure 13. Excerpt from 1904-05 Catalog describing requirements for the master's degree

These updates required students to have a year's residency at Howard, pass an exam in their general field of study, deliver a presentation of their thesis and pay an additional fee of \$25 (Howard University, 1904). In 1905 four students received a master's degree (Hilltop Staff, 1936). They were John Henry Bluford, James F. Johnson, Thomas Wyatt Turner, and Edward D. Williston (Dyson, 1941; Howard University, 1919a).

Up until 1911 graduate students were supervised by a faculty member in their field. However, in 1911 a special committee was formed and took over the supervision of graduate students (Dyson, 1941). The members of this first special committee were Dean Kelly Miller, Dean L. B. Moore, William V. Tunnel, W. Carl Ruediger, and Benjamin G. Brawley (Dyson, 1941). Under this committee, Jean Hamilton and C. C. Robinson received master's degrees in 1911 and D.O.W. Holmes⁶ in 1912 (Dyson, 1914). The special committee would eventually

⁶ D. O. W. Holmes earned an honorary master's degree in 1912 (Howard University, 1919a). He later became the first Dean of the Graduate School at Howard University (Dyson, 1941).

become the Committee on Graduate Studies. Until 1919, graduate work at Howard followed these guidelines, with faculty members in the College of Liberal Arts and Teachers College, recommending students for the master's degree (Hilltop Staff, 1936).

The next change in graduate work at Howard was outlined in the 1919-1920 catalog (Appendix D). At this time graduate work became supervised by the Committee on Graduate Studies chaired by the Dean of the College of Liberal Arts. Woodard joined the faculty at Howard in 1920 and shortly after was appointed as Dean of the College of Liberal Arts thus becoming the chair of the Committee on Graduate Studies (Dyson, 1941; Logan, 1969). Then a year later in 1921 as a recommendation from then university president, James Stanley Durkee, the Committee on Graduate Studies was given "absolute charge of all graduate work" (Howard University, 1926, p. 13). Other members of the committee included Deans of the School of Religion and the School of Education, as well as, Professors Ernest E. Just and St. Elmo Brady, and Assistant Professor Alain L. Locke (Howard University, 1919b, 1923). Under these new guidelines students who wished to enter the master's program were now required to apply and have their application approved by the Committee on Graduate Studies as opposed to being recommended by an individual faculty member. Students were required to take a minimum of eight classes in addition to completing a thesis. In addition language requirements were introduced in these new guidelines. Students were required to have a reading knowledge of French or German. Students were also expected to pass an oral examination on topics in their general field of study (the previous description mentions an exam but does not specify if it is an oral exam). The fee for the master's degree was increased to \$50 plus a \$25 fee for graduation and diploma. In the 1919-1920 course catalog only five departments awarded masters degrees. They were Biological Science, Comparative Literature, History and Culture of the Negro,

Education, and Theology. Many other departments would join this list in the following years including Chemistry, German, and Mathematics (Howard University, 1923).

Teaching Fellowships were introduced in 1921, allowing masters students to teach one class in their field and providing them with financial compensation ranging from \$150-\$500 (Dyson, 1941; Howard University, 1926). Teaching fellowships were granted on the recommendation of Woodard (Dyson, 1941). The year that teaching fellowships were introduced a young woman named Irene Miller was named a Teaching Fellow for the mathematics department (The Evening Star, 1922). Irene Miller is the daughter of Kelly Miller⁷ and she received a master's degree from Howard in mathematics in 1922 (The Evening Star, 1922; Howard University, 1922). Her thesis was titled *A Study of the Function of a Complex Variable z Defined by the Equation $\omega^3 - 3a\omega z + bz^3 - 1 = 0$* (Howard University, 1922). This is the first documented masters degree in mathematics for Howard that I could find. Although it is possible that there were other masters degrees granted in mathematics before 1922, those who received these degrees were documented more consistently in course catalogs, commencement programs and newspaper articles in later years.

According to the 1928-1929 catalog (The Graduate Division excerpt can be seen in Appendix C), candidates for the master's degree must have received a bachelor's degree from Howard or another college of "recognized standing" and proved to the Committee on Graduate Studies that they are "qualified by antecedent studies for profitably pursuing the subjects selected for graduate work (Howard University, 1928b, pg. 144)." Students were still required to take a minimum of eight courses and complete a thesis, have a reading knowledge of French or

⁷ Kelly Miller was first mentioned in Chapter 2. He was a faculty member at Howard University. During his time at Howard he served as the Dean of the College of Liberal Arts, Dean of the Junior College, mathematics and sociology professor. His son also earned a bachelor's in mathematics from Howard in 1886. Miller and Woodard's paths crossed many times.

German, and pass an oral exam on the general field of study. During the 1929-1930 academic year, Howard offered graduate level courses in Botany, Chemistry, Educational Sociology, Educational Psychology, History, Education, German, Philosophy, Psychology, Zoology, and Mathematics (Howard University, 1929a). The graduate level courses offered in the mathematics department include Theoretical Mechanics I and II, Introduction to Higher Algebra, Theory of Groups, Metric Differential Geometry, Analysis Situs I & I, Theory of Numbers, Theory of Algebraic Numbers, Theory of Functions of Complex Variable, and Theory of Functions of Real Variable (Howard University, 1929a). In the next years the department added more graduate courses including The Mathematical Theory of Probability, Analytic Projective Geometry, Metric Differential Geometry, Vectors and Matrices in higher Algebra, Algebraic Invariants, Linear Algebra, Fourier Series and Integrals, and Theory of Sets (Howard University, 1931). Though the professors for each class are not specified, the faculty in the department at the time included William John Bauduit⁸, Charles Sumner Syphax⁹, and Woodard as Professors and Associate Professor Elbert Cox (Howard University, 1929a). Based on a search of commencement programs, course catalogs (which listed registered students) and yearbooks, the first masters degree in mathematics under this new iteration of graduate study at Howard was awarded to a Paul Hasty in 1929. His thesis was titled *On the Analysis Situs of a Bounded Two-Dimensional Space* (Howard University, 1929a, 1929b). The next students to earn a master's degree in mathematics were William Schieffelin Claytor and Clarence Reed White in 1930. Claytor's thesis was titled *A characterization of a one sided surface* and White's thesis was titled

⁸ William John Bauduit received a bachelor's and master's degree from the University of Chicago in 1909 and 1912 (University of Chicago, n.d.b). A comparison of their University of Chicago shows they did not take any classes together. However, it's likely they knew each other during the two years they were both there. Bauduit started at Howard in 1912 as an instructor but worked his way up to associate professor (Zitarelli, 2022).

⁹ Charles Sumner Syphax, was a member of the prominent Syphax family of Washington, D.C.. He received a bachelor's degree from Howard in 1888. He also received a bachelor's and master's in law in 1899 and 1900 (Howard University, 1929a).

Study of an unbounded two-dimensional manifold (The Afro-American, 1930; Howard University, 1930). I will go into more detail about these students in the following section.

According to Dyson (1941) during the 1920-1921 school year graduate study “took on new life” (Dyson, 1941, p. 182). He goes on to say, “Dudley Weldon Woodard, professor of mathematics and dean of the College of Liberal Arts, was the leading spirit in these endeavors. The beginnings of graduate work in course at Howard University is indebted to his interest and efforts” (Dyson, 1941, p. 182). During Woodard’s first eight years at Howard as the Dean of the College of Liberal Arts and chairman of the Committee on Graduate Studies, he along with his colleagues on the committee worked to not only restructure graduate work at the university but also advocated for its existence. Only a small group of professors, most of them serving on the Committee for Graduate Studies, saw the necessity of graduate studies at Howard and in the coming years worked hard to get the rest of the university on board (Dyson, 1941). One major concern was the capacity of the existing faculty with the increase in enrollment of undergraduate students. There was an emphasis on teaching over research at the university during this time (Parshall, 2016). In 1904 when members of the faculty asked the Board of Trustees for permission to organize graduate work more thoroughly, the board agreed with the following conditions: “that this shall not constitute a graduate school; that no payment shall be made for instruction; and that teaching in such courses shall not be counted in making up the total requirement of hours” (Dyson, 1941, p. 180). So the faculty was allowed to streamline graduate studies but it could not interfere with their instruction of undergraduates. Eventually, the Graduate School would be formed and graduate faculty would be established but it took years to get everyone on board.

In 1929 Woodard retired from his position as Dean of the Liberal Arts College and thus also as the chairman of the Graduate Committee though he remained a member of the committee. Under the new committee, chaired by the new Dean of the College of Liberal Arts Dr. E. P. Davis, the university continued to expand and formalize graduate studies. This resulted in the first Graduate Division Bulletin being established in 1931 and on April 14, 1934 the Board of Trustees voted to establish the Graduate School as its own separate division within the university for non-professional graduate work under the president, the dean of the Graduate School and Graduate Council (Dyson, 1946; Hilltop Staff, 1936). Thus came an increase in awareness of graduate work at Howard and an increase in admissions.

The establishment of the Graduate School was specifically designed for non-professional graduate work. Howard had been awarding professional degrees in medicine, dentistry, pharmacy, law and religion since its founding (Dyson, 1941; Howard University, 1919; Logan, 1969). In addition to doctorates of medicine and pharmacy, the professional school also awarded master's degrees in law and theology as early as 1872 (Dyson, 1941; Howard University, 1919). This all laid the foundation for Howard doctoral programs that would come in the 1950s¹⁰.

PhD Program in Mathematics at Howard

In the 1970s Howard made major expansions to the university. Among these expansions was the establishment of the PhD degree in mathematics (Howard University Catalog, 1979). The establishment of the program was led by mathematician and department chair James Donaldson and this was the first PhD program in mathematics at an HBCU (Donaldson & Fleming, 2000; Hunt et al., 2021, Walker, 2014). Like Woodard, James Donaldson also spent the majority of his career at Howard shaping the doctoral program, mentoring students, and

¹⁰ Howard awarded its first doctoral degree in 1958 in chemistry. The doctoral program in mathematics was established in 1975 (Walker, 2014).

recruiting other mathematicians with PhDs to join the mathematics faculty (Hunt et al., 2021). Donaldson joined the faculty at Howard in 1971, after Woodard's retirement and passing. However, he did overlap with other members of the faculty including Elbert Cox (Howard University, 1971).

5.2 Structure of master's program in mathematics

Once the Graduate School was established the structure of the masters program was set and the requirements formalized. The Committee on Graduate Studies was involved in every aspect of the process from admissions to administering the final examination. In 1934 the committee consisted of University President Mordecai W. Johnson, chairman and Dean of the College of Liberal Arts Edward P. Davis, Charles H. Thompson, Dwight O. W. Holmes, Ernest E. Just, Alain L. Locke, D. Butler Pratt, Charles H. Wesley, and Woodard. This committee approved students for admission into the program and for teaching and research fellowships. The objectives for students pursuing a master's degree were outlined as such; "(1) The acquirement of a special competence in one or more fields of knowledge; (2) The development of the capacity to think independently and constructively in one or more special fields; and, (3) The attainment of the power to organize and evaluate knowledge concerning special topics in one or more special fields, and to formulate and present definite conclusions as evidence of the mastery of information and skill" (Howard University, 1938, p. 63).

The prerequisites necessary for admission included having a bachelor's degree from Howard or an approved college. Applicants were required to submit a list of undergraduate courses taken in the field of graduate studies they are applying for. If the applicant's undergraduate education didn't meet the requirements to begin graduate work in their chosen department, then the applicants were required to meet these requirements in addition to the

requirement of their graduate work. Applicants were also required to have chosen a thesis topic with the approval of the professor who would serve as their advisor.

Once admitted students were required to complete 30 credits. The breakdown of these credits can be found in figure 14. Twenty-four credits were for course work and 6 credits were for thesis work.

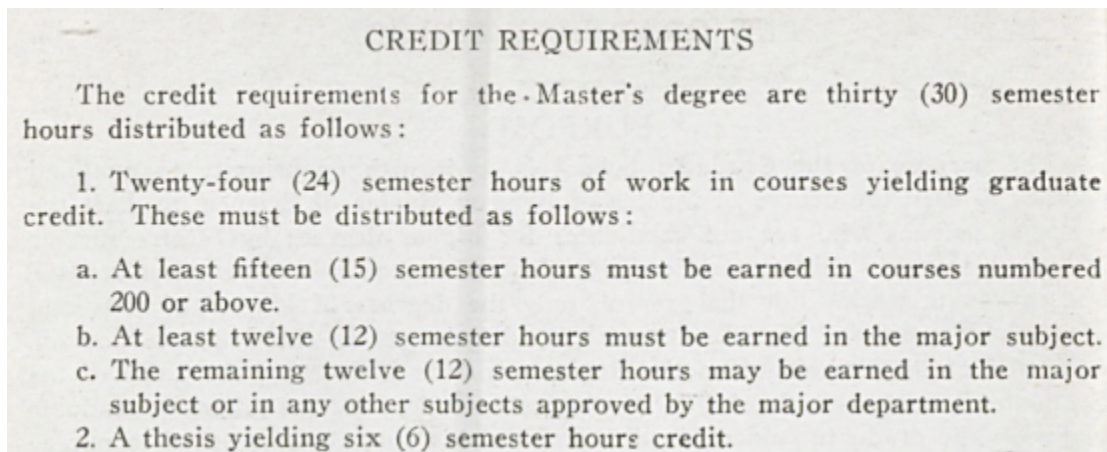


Figure 14. Except from Howard University 1938-39 Catalog

Students were required to have a reading knowledge of at least one foreign language determined by their department (previous catalogs listed French or German). Students were also required to complete a thesis project which they submitted to the chairman of the Committee on Graduate Studies. Lastly, students were required to pass a comprehensive final oral exam covering their field of study. This exam was administered by the chairman of the Committee on Graduate Studies and the student's department advisor.

The departments who offered graduate work during this time were Botany, Chemistry, Economics, Education, English, German, History, Mathematics, Philosophy, Physics, Political Science, Psychology, Religious Education, Romance Languages, Sociology, Social Work, and Zoology.

Each department offering graduate work had their own additional requirements. For the mathematics department the prerequisites for the masters program included students having 30 credits in courses listed by the department for undergraduate studies. The courses offered in the undergraduate division for mathematics at Howard at the time were Elementary Algebra, Algebra to Quadratics, Quadratics and Beyond, Solid Geometry, Advanced Algebra, Plane Analytic Geometry, Astronomy, The Mathematics of Finance, Differential Calculus, Theory of Equations, Projective Geometry, Solid Analytic Geometry, Differential Equations, History of Mathematics, Limits and Series, and Advanced Calculus I and II (Howard University, 1933, 1938). The mathematics department also required students to have a reading knowledge of German or French. Interestingly, the knowledge of a foreign language was also a requirement in the mathematics department in the undergraduate division (Howard University, 1933, 1938). Of these courses Woodard taught Advanced Algebra, Plane Trigonometry, Plane Analytic Geometry, Differential Calculus, Integral Calculus Limits and Series and Advanced Calculus I and II.

The graduate level courses offered by the mathematics department were Introduction to Higher Algebra, Theory of Groups, Analytic Projective Geometry, Metric Differential Geometry, Topology I and II, Theory of Numbers, Theory of Algebraic Numbers, Theory of Functions of Complex Variable, Linear Algebra, Theory of Functions of a Real Variable, Readings in Mathematics, and Thesis Work in Mathematics. Of these classes Woodard taught Topology I and II, Theory of Functions of a Complex Variable, Theory of Functions of a Real Variable, Readings in Mathematical and the Thesis course.

5.3 First Students

Many of the first students to earn a 'second degree' at Howard were alumni and members of the faculty. For example, D. Augusta Straker and John Henry Smyth, both members of the

Law Department faculty, were granted Masters in Law in 1871 (Dyson, 1941; Howard University, 1919). In addition to this four members of the medical department faculty were awarded honorary masters degrees in 1870 and 1871 (Dyson, 1941). And there's D. O. W. Holmes, professor of education, who earned an honorary masters degree in 1912 and later became the first Dean of the Graduate School (Dyson, 1941, Howard University, 1919, 1920). There was an effort being made by Howard to attract more faculty members with advanced degrees. Thus by 1943, Howard employed 70 of the 381 African Americans who had earned a doctorate degree; eight of them were in the mathematics department: David Blackwell (University of Illinois at Urbana-Champaign, 1941), William Schieffelin Claytor (University of Pennsylvania, 1933), Elbert Cox (Cornell University, 1925), Reuben McDanie (Cornell University, 1938), Joseph Pierce (University of Michigan, 1936), Walter Richard Talbot (University of Pittsburgh, 1934), J. Ernest Wilkins, Jr. (University of Chicago, 1942), and Woodard (Donaldson, & Fleming, 2000, Walker, 2014). One of them, William Schieffelin Claytor, was among the first students to earn a master's degree in mathematics at Howard.

Many of the first student's to earn a masters degree in mathematics from Howard went on to have extensive careers at HBCUs, public high schools and with the military. For example, Paul Hasty earned his master's degree in mathematics in 1929 from Howard. He received his bachelor's degree from Miami University of Ohio (Times Herald, 1929) and attended Howard for one year as he pursued a master's degree (Howard University, 1929a, 1929b). I found an article (figure 15) that supports Hasty having attempted to pursue a doctoral degree.

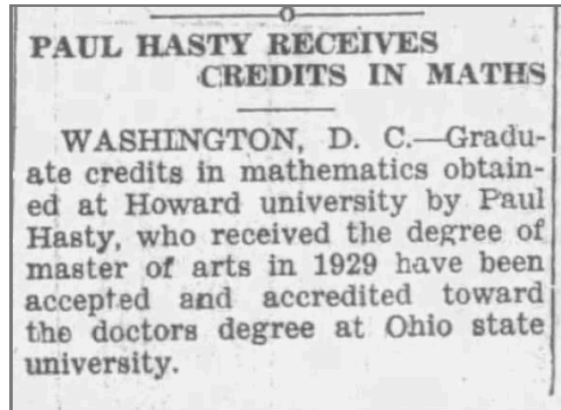


Figure 15. Article from The Kansas City American on Paul Hasty

Hasty's credits from his master's studies at Howard were accepted and applied towards a doctoral degree at Ohio State University (The Kansas City American, 1930). However, there is no record of Hasty having received a doctoral degree. After receiving his master's degree, Hasty became a professor of physics at Wilberforce University, Woodard's alma mater and former employer (New Pittsburgh Courier, 1930) and he remained there until he became the principal of East High School in Youngstown, Ohio and director of the night school there in 1935 (Gazette News-Current, 1935a, 1935b).

The next two students to earn a master's degree from this program were Clarence Reed White and William Schieffelin Claytor in 1930. White's thesis was titled *Study of an unbounded two-dimensional manifold* and Claytor's thesis was titled *A characterization of a one sided surface* (The Afro-American, 1930; Howard University, 1930).

Clarence Reed White was a graduate of Dunbar High School in Washington, D.C. in the same class of Woodard's son, Dudley H. Woodard (The Evening Star, 1924). White received his bachelors from Amherst College in Massachusetts (The Afro-American, 1928; Howard University, 1930) before receiving a fellowship to attend Howard's master's program in mathematics (Rosenberg, 2013). While White was working on his masters degree at Howard he

was also an instructor (The Evening Star, 1930). This aligns with the teaching fellowships developed along with the masters program in mathematics (Dyson, 1941; Howard University, 1926). After Howard, White studied at The University of California at Berkeley for five years in the Astronomy department though it is unclear if White received another graduate degree (Rosenberg, 2013). White had a long teaching career in secondary schools and higher education institutes. He taught at many HBCUs including Bethune-Cookman College, Louisville Municipal College, Delaware State College, Fort Valley State College, and the Hampton Institute. He also had an extensive career as a physicist for the United States military. White along with his wife, Richie Dean Williams, also a mathematician and educator, published the book *Two Mathematicians Play Contract Bridge* in 1975 shortly after White's death (Rosenberg, 2013) which gave a guide to bidding in the card game bridge developed by White and Williams (White & Williams, 1975).

William Schieffelin Claytor

William Schieffelin Claytor received a master's degree in mathematics from Howard in 1930 (The Afro-American, 1930; Howard University, 1930). Claytor also received his bachelor's degree from Howard in 1929 (Howard University, 1929b) and was one of the first students enrolled in the masters program in mathematics under Woodard and colleague Elbert Cox. Claytor's area of study was topology like Woodard. While a masters student advised by Woodard, Claytor got his first publication in the *American Mathematical Monthly* in 1929. He published a solution (Appendix E) to a limit problem posed the year before (Ivanoff et al., 1929).

Under Woodard's recommendation, Claytor applied to the University of Pennsylvania and began working on a doctoral degree under Woodard's same advisor, John R. Kline (Parshall, 2016). After a successful first year, Claytor was awarded the prestigious Harrison Scholarship

and a Harrison Fellowship (The Afro-American, 1932; Evening Star, 1932; Times Herald, 1932). These awards were given to exceptional and promising students (Parshall, 2016). Claytor finished his dissertation in 1933 becoming the third African American to earn a PhD in mathematics (Donaldson, 1989; Parshall, 2016). He published his dissertation titled “Topological Immersion of Peanian Continua in a Spherical Surface” in the *Annals of Mathematics* in 1934 (Donaldson, 1989; Parshall, 2016). By the time Claytor earned his PhD he had established himself as a promising topologist and aspired to continue his research at a research institution. However, his first position after earning his doctoral degree was a teaching focused position at a small historically Black college, West Virginia State College¹¹ (The Charleston Daily Mail, 1932; Parshall, 2016).

Claytor with the support of his advisor tried to secure a research focused position so that he could continue honing his research skills. Claytor took a year long leave from West Virginia State to do research at the University of Michigan with famed topologist Raymond Wilder in 1936. However, this did not come with the usual stipend or title. Claytor had to rely on his own savings to support himself for that year. The time he spent at the University of Michigan resulted in Claytor presenting the results of his research at the AMS meetings in 1937 and his second and last publication titled “On Peanian Continua Not Imbeddable in a Spherical Surface” in *Annals of Mathematics* the same year (Claytor, 1937). Claytor received a Rosenwald Fellowship and used it to continue his research at the University of Michigan for an additional two years (Atlanta Daily World, 1937; The Charlotte Observer, 1937; Parshall, 2016). In the end, even after spending an unpaid year at the University of Michigan and having presented and published exceptional work, Claytor was still denied employment at any white institution because of race based discrimination. Claytor then spent some time in the United States Army and later taught at

¹¹ Elbert Cox also taught at West Virginia State College before joining the faculty at Howard.

Southern University, a historically Black college in Louisiana all before returning home and joining the mathematics faculty at Howard University in 1947, the same year Woodard retired (Parshall, 2016; Howard University, 1948). As it was with Woodard and Cox, HBCUs and specifically Howard University welcomed Claytor at a time when white institutions would not. At this time Howard still emphasized teaching over research and Claytor's heavy teaching schedule did not allow him to continue his research.

Another notable student of Woodard is Marjorie Lee Browne. Though she did not receive her masters degree from Howard University, she attended Howard as an undergraduate student receiving a bachelor's degree in 1935. She later earned a PhD in mathematics from the University of Michigan in 1950 becoming only the third African American to do so¹². She later joined the mathematics faculty at North Carolina Central University, a public historically black college, and remained there throughout her career.

Between 1919 to 1955 Howard had granted 1048 master's degrees in twenty different departments (Howard University Catalog, 1957). According to a recount of the Graduate School in the 1957-1959 Course Catalog, 60% of these graduates worked in education with many working at the college level (Howard University Catalog, 1957). This trend remains true for the students of mathematics as evident in the careers of the student trajectories outlined above. Though not all students became faculty members at HBCUs, one major result of expanding graduate studies at Howard was the development of talented educators, mathematicians, and scientist, as well as professionals in the fields of law and medicine that went on to support HBCUs, Black students, and the progress of Black people.

¹² The first was Euphemia Lofton Haynes who earned a PhD from the Catholic University of America in 1943. Haynes taught at Howard for a period (Howard University, 1945). The second was Evelyn Boyd Granville who earned a PhD from Yale University in 1949.

Chapter 6: Conclusions and Recommendations

The purpose of this study was to explore the life and career of mathematician and mathematics educator Dudley Weldon Woodard and the establishment of graduate work at the university, specifically in the mathematics department, and Woodard's contributions.

This study was guided by various research questions, which are answered below.

6.1 Research questions answered

Research question 1: What can be discovered about Dudley Weldon Woodard's life and career in mathematics and mathematics education?

Chapter 4 presents an outline of Woodard's life and career. Woodard spent his childhood in Galveston, Texas at the end of the 19th century. Only a little information could be gathered regarding his family. However, his father worked for the United States Post Office which was a highly sought after and well paying job for African Americans at the time. His father also may have completed one year of college. I was not able to find any information on Woodard's mother's schooling or occupation. Examining these archival records shows us that Woodard was the first in his family to complete college. However, these records do not reveal Woodard and his family's motivation around this. The records also reveal to us that Woodard lived with and was raised by his aunt, Gertrude Bravo, instead of his parents. African Americans have always emphasized the importance of education for their mobility in this country, especially following the Civil War (Anderson, 1988; Davis, 1993; Perry, 1993). I imagine it was no different for Woodard's family, that they too emphasized the importance of education to a young Woodard and the freedom that it brought. I imagine that they supported him in obtaining that education, arranging transportation to college, signing official documents as his guardian, encouraging him

through his studies. A college degree was one thing but had they imagined that he would receive the highest degree in mathematics? Something that not many had done before him.

HBCUs played a major role in Woodard's life and career. From receiving a bachelor's degree from Wilberforce University to teaching at the Tuskegee Institute, Wilberforce and Howard University, these HBCUs were guideposts in Woodard's career. Though it has not been documented whether Woodard tried to seek employment at any white institution, throughout his career employment at white institutions was not open to African Americans, even those with advanced degrees like the case of Woodard's student William Claytor, due to race based discrimination. Woodard and his students were able to attend these institutions, namely those in the north, to receive advanced degrees. Woodard received a second bachelor's and a master's degree from the University of Chicago and his PhD in mathematics from the University of Pennsylvania. However, when it came time to find employment, they turned to HBCUs.

Given their teaching load at Howard along with Howard's emphasis on teaching over research, Woodard did not have the time to continue his own mathematical research. However, he still managed to publish during his career. He published two mathematical research articles in 1929 and 1939 while a professor at Howard. While he was a faculty member at Tuskegee he published a textbook on arithmetic, a study of teaching geometry and a study on the progress of Jackson, Mississippi. Both his textbook on arithmetic and his study of teaching geometry at Tuskegee give us some insight into Woodard's teaching philosophy. In *Practical Arithmetic* he emphasized the importance of probleming solving and learning by doing. He also emphasized the benefits of working collaboratively with peers as well as with other departments at the college. He demonstrated this by collaborating with his colleagues in every department to create the problems for the textbook. These ideas also appeared in Woodard's study on teaching

geometry at Tuskegee. He emphasized the importance of having students work together in small groups outside of class to promote collaboration while preserving instruction time. He also emphasized the importance of giving students the chance to create their own problems that are relevant to their work by having them start with a specific problem and develop it into or connect it with an abstract idea. Lastly he stressed the importance of giving students a theoretical and practical understanding of their trade creating work that is engaging and enjoyable for both teacher and students (Woodard, 1913).

Outside of teaching and research Woodard turned to taking on leadership roles throughout the universities where he worked. He served as the Head of the Division of Mathematics while at Tuskegee. While at Howard he served as Dean of the College of Liberal Arts for many years and served on several committees including the Committee on Graduate Studies. In this role he was directly involved with the development of graduate studies at Howard. In addition to this he was faculty supervisor of the Mathematics Society, the editor of the scholarly magazine *The Howard Review*, a member of the university council committee and the curriculum committee and a member of the board of examiners and the rating committee. By serving in each of these positions at various points throughout his career, Woodard remained very involved with the students, specifically mathematics students, at Howard but he also was involved in the practices and processes of the university as a whole by shaping graduate studies, admissions, curriculum, editing research and so on.

Research question 2a: What were the circumstances around the establishment of Howard University's graduate program in mathematics? What was the organization and structure of the program, and how did this evolve over time? For example, what were the requirements for the program?

Graduate work was a topic of discussion since the founding of Howard University in 1867. However, it took many years and the effort of many leaders to formalize graduate studies resulting in the establishment of the Graduate School in 1934. Non-professional ‘second degrees’ were granted as early as 1871 on a case by case basis to graduates of the university with at least one year of professional work. By the time the Graduate School was established several requirements for the master of art or masters of science degree were outlined. In order to be accepted into the Graduate School, candidates had to have graduated from Howard with a bachelor’s degree or received a bachelor’s degree from another approved institution. Candidate's majors had to have been in a department approved by the Committee on Graduate Studies. In 1934 the departments that offered graduate courses were Botany, Chemistry, Economics, Education, English, German, History, Mathematics, Philosophy, Physics, Political Science, Psychology, Religious Education, Romance Languages, Sociology, Social Work and Zoology. Once admitted each candidate had to spend at least one year of residency at Howard and they had three years to complete their degree though it took many of the students one year.

Regarding courses, each student was required to complete eight graduate level courses which needed to be approved by the Committee on Graduate Studies. Only courses where the student received a B or better would count towards the degree. However, all courses, even those where the student received a C or lower were listed on their record. The graduate level courses offered by the mathematics department were Theory of Groups, Analytic Projective Geometry, Metric Differential Geometry, Topology I and II, Theory of Numbers, Theory of Algebraic Numbers, Theory of Functions of Complex Variable, Linear Algebra, Theory of Functions of a Real Variable, Readings in Mathematics, and Thesis Work in Mathematics. Of these classes

Woodard taught Topology I and II, Theory of Functions of a Complex Variable, Theory of Functions of a Real Variable, Readings in Mathematical and the Thesis course.

Each student was required to complete a thesis. They were assigned an advisor from their department who helped guide them through this project from deciding on a topic to familiarizing themselves with the techniques of research in their field. These theses were submitted to the Committee on Graduate Studies. Students were also required to take an oral final exam. This exam was administered by the Committee on Graduate Studies and their department and was a comprehensive exam on the courses the student took. Students were given two chances to take and pass this exam.

Research question 2b: What were Woodard's contributions?

Woodard's education and career prior to joining the faculty at Howard University and becoming Dean of the College of Liberal Arts and Sciences prepared him for the impact he would have at Howard. Having attended an HBCU, having received a master's degree in mathematics, having taught at HBCUs Tuskegee and Wilberforce and stepping into leadership roles at both institutions, all informed the second half of his career. Woodard contributed to the establishment of graduate studies at Howard University in many ways but mainly in his role as Dean of the College of Liberal Arts and chairman of the Committee on Graduate Studies. Together the members of this committee worked to increase the support of graduate studies among other faculty members as well as to structure and formalize the process for students working towards the master's degree. The committee was in charge of admissions, oversaw the student's final exam and final approval for the master's degree. Specifically in the mathematics department, Woodard taught many of the graduate level courses including the topology courses which was his field of study. Woodard implemented and oversaw teaching and research

fellowships for master's students. He also served as an advisor to many students in the mathematics department.

The work done by the Committee on Graduate Studies resulting in the establishment of the Graduate School helped expand awareness around graduate work at Howard, helped shift the university's emphasis on teaching to also include research, and helped attract more faculty with advanced degrees. All laying the groundwork for the establishment of the PhD program in mathematics at Howard and strengthening the practices of support for students resulting in Howard continuing to be among the top HBCUs to produce Black STEM PhDs.

Research question 3: How did Woodard and other faculty members at Howard mentor students in the master's program and beyond?

During Woodard's time at Howard, outside of teaching, there were many opportunities for him and his colleagues to mentor and advise students. For example, for a time Woodard served as the faculty advisor for the Mathematics Society. This society gave both faculty and students a chance to explore topics in mathematical research. The society collaborated with faculty members outside of the mathematics department to deliver talks and present interesting problems to students. Students were thus exposed to the process of mathematical research and its many applications.

Woodard was a thesis advisor for many students, partially those studying within the topological field. As outlined in chapter 5, one of his most promising students was William Schieffelin Claytor, who became the third African American to earn a PhD in mathematics, earning his PhD under the same dissertation advisor as Woodard. Claytor eventually came back to Howard as a faculty member in the mathematics department. Many of the students in the mathematics program went on to earn a PhD in mathematics and/or became educators, some at

the high school level but many at the college level at HBCUs. Both through direct advisement and from leading by example, Woodard and his colleagues helped prepare and shape their students into promising mathematicians, educators and mentors.

6.2 Conclusions

Woodard came from humble beginnings, he attended a segregated high school and still dreamt and made the dream come true of earning a PhD in mathematics. According to Kenschaft (1987) in a personal account Woodard expressed he did not experience any disadvantages growing up. I imagine his journey to college at an HBCU was a smooth one as was his career into education; first beginning as a secondary school teacher at his old high school in Galveston, Texas, to becoming a professor at Howard University. Woodard left his mark both on the field of mathematics with his own research and through the students he mentored. He also left his mark on HBCUs through the work he did at Wilberforce, Tuskegee, and Howard as well as through his students that he guided that eventually took positions at HBCUs. This study sought to explore the life and career of Woodard to gain an understanding of the significant impact he had on mathematics and mathematics education at Howard as well as the practices put in place at the start of the graduate program in mathematics at Howard that continues to support Black students in mathematics.

Throughout the process of completing this project two questions continued to come up for me; what made Woodard decide to get a PhD in mathematics and given the circumstances, i.e. race based discriminatory hiring practices at white institutions, why encourage his students to also pursue masters and PhDs in mathematics? The exact answers to these questions are not explicit in the archives. There are no personal papers of Woodard explaining his exact feelings about this. However, we can look at the results of these two things happening and come to a

conclusion. Whether Woodard knew it or not, pursuing a PhD in mathematics set an example for his students of the possibilities available for them. Encouraging and empowering them to do the same, created a foundation of Black mathematicians who would also become researchers, mentors and teachers for the following generations of Black mathematicians. Though things eventually shifted in this country and white institutions began hiring African Americans in faculty positions, for many of Woodard's early students this was not the case so they too spent their careers at HBCUs—thus strengthening the legacy of HBCUs and their important role in the education of African Americans.

Woodard was described by others as “an extremely nice man, well balanced personally” and “one of the noblest men I have ever known” by topologist Leo Zippin (Kenschaft, 1987, p. 173). He was remembered by his students at Tuskegee as tough but challenging (Tuskegee Institute, 1914). He is remembered by his family as extremely curious, always studying, always a student, and kind. Getting to know Woodard through his presence in the archives, the accounts of Black mathematicians and accounts of the development of graduate studies at Howard, I too would describe him as noble, curious and kind.

6.3 Limitations of the Study

I began looking for archival documents to support this study beginning in 2019. Unfortunately, because of the Covid-19 Pandemic my access to archives were limited. I had to rely on digital archives to carry out my research. Fortunately, Howard University has an extensive digital archive that I was able to access and find a lot of sources for this study. However, there were some documents that have not yet been digitized that would have helped with this study.

I used federal and local government records as well as newspapers to discover the details of Woodard's early life. Though I was able to gather a lot of information, there are still gaps in his story due to the inconsistencies of these records. For example, his mother seems to disappear from census records for many years. The census records were recorded by hand during this time and they were not always legible resulting in inconsistencies in things like age, occupation, education, and the spellings of names. In these cases I tried my best to find other sources to corroborate this information.

I used a variety of sources to confirm the students who received master's degrees from Howard—commencement programs, student lists in the annual catalog, an alumni directory, yearbooks, newspaper articles. These records were not always consistent. Sometimes the list of names were not exactly the same or the year the degrees were awarded differed. Having appeared in any of these records does not guarantee a degree was awarded. However, I believe it is okay to assume that the students who showed up consistently in many of these records likely did receive the degree. For the ones who have only been listed in one or two of these sources, they probably received the degree as well but at the very least they were likely students of the program.

While working on this project I did not come across any personal papers belonging to Woodard. It is possible that his personal papers were not properly saved. It is equally likely that his papers exist but have not been preserved or given to an archive. With more time and sources I would continue to look for his personal papers. Though I was able to discover a lot of information about Woodard, something that doesn't show up explicitly in the records I found was a sense of Woodard's personality and motivations. We can make inferences about these things but having personal accounts from Woodard and from those who knew him would give more

insight. Personal papers are another important and useful resource for studies like these. It is paramount that we take the proper steps to preserve the personal papers of these important figures.

6.4 Recommendations for further research

Even up until my final days of writing this dissertation I continue to find new and interesting things in the archives, connections to Woodard that I did not expect. There will always be more to add. One area future research can focus on is the development of PhD programs at HBCUs, specifically at Howard University. Howard granted their first PhD in chemistry in 1958. The PhD program in mathematics was established in 1975 under the leadership of mathematician James Donaldson and there is no doubt that the work towards the masters program in mathematics laid the foundation for the PhD program in mathematics.

Another under explored topic that could be a topic for future research is the life and careers of other early mathematicians, namely William Claytor (Parshall, 2016). Like Woodard, Claytor also spent his career teaching at HBCUs and helping in the development of future mathematicians. One of his many notable students was Katherine Johnson, whose influential work with NASA has been brought to the mainstream recently with the film *Hidden Figures*. Claytor was Katherine Johnson's professor while at West Virginia State College. Claytor served as a mentor for Johnson, teaching her mathematics and even adding advanced courses to the curriculum just for her (Houston, 2019). In Johnson's remarks she says Claytor told her she would make an excellent research mathematician and that he would help her become one (Deiss, 2020). From what has been revealed about Woodard and his contributions to the mathematics department at Howard University and his students, we stand to learn more of the foundational

building blocks of the mathematical departments at HBCUs by exploring the lives and careers of other early Black mathematicians, stories that are not well known or told.

Another area for future research is Woodard and Claytor and their students' role in the beginning stages of topology as a field. They were working with and alongside topologists like Raymond Wilder and their thesis advisor John R. Kline. Both Wilder and Kline were students of topologist R. L. Moore. Moore is well known for his contributions to topology and the Moore Method which is a flipped classroom approach to teaching advanced mathematics where students lead the class through problem solving. In addition to these contributions Moore is also known for his refusal to work with African American and women students. So it is noteworthy that Woodard and Claytor are among his academic 'grandsons'. Claytor was published alongside Hans Freudenthal in *Annals of Mathematics*, another mathematician who made important contributions to algebraic topology. Like the topologists who trained them and their peers, Woodard and Claytor should also be mentioned in the history of the field.

6.5 Final Remarks

Before starting this project, whenever I heard or read about Woodard, two things would always be present—he was the second African American to receive a PhD in mathematics, and he started the graduate program in mathematics at Howard. As I began looking through the archives and gathering more information about Woodard I discovered how large his impact was. He did not just contribute to the development of the master's program in mathematics at Howard, he helped shape and reimagine non-professional graduate study throughout the entire university. He, along with his colleagues and successors like James Donaldson, another prominent figure at Howard and in mathematics who developed Howard's PhD program in mathematics, laid a strong foundation for the mathematical sciences at Howard University and beyond, by seeding

teachers, faculty, and researchers in the mathematical sciences whose contributions are still felt today. What Woodard did can't be redone. However, we can continue to learn from his teaching, mentoring, and leadership practices on how to best support Black students in STEM and HBCUs.

During the time that Woodard and colleagues on the Committee for Graduate Studies were working to formulate graduate studies at Howard, there was an emphasis at Howard for the faculty members to focus on teaching over research. Woodard's and others' teaching loads made it more difficult for them to work on their own mathematical research. However, Woodard still managed to publish two mathematical research papers. He also encouraged masters students to develop their mathematical research and teaching practices which was evident in the thesis requirement for the masters degree as well as the teaching fellowships made available for masters students. He, and other members of the department, encouraged their students to continue their mathematical research and pursue PhDs in mathematics. Woodard was only able to do so much with his research but I imagine he saw a future where there would be more opportunities and he prepared his students for that future. This future was not realized for William Claytor, Woodard's student and a promising research mathematician, because of race-based discriminatory hiring practices at white institutions. However, Claytor carried on these ideals with his own students. For example, he saw his student Katherine Johnson's potential, encouraged her to be a research mathematician and supported her in doing so. Eventually things would shift at Howard. With the establishment of the PhD programs, there came an emphasis on developing both research and teaching practices for faculty and students.

Woodard had a long and impactful career in mathematics and mathematics education and it has been a pleasure getting to know him and his work through the archives. Woodard's story and the stories of other Black mathematicians are important to me because as a Black woman

studying mathematics there was a time when I didn't know they existed and thus didn't feel like I belonged. But learning more about their lives and journeys in math helped me develop a sense of belonging in the mathematics community. Learning more about Woodard's career as a mathematician and educator gave me insight for my own teaching practices. When I am standing at the front of a classroom with my own students of mathematics or mathematics education I have Woodard (and Cox and Claytor and Stephens and their colleagues and their practices) in mind. I ask myself, am I supporting my students in their mathematical journeys, am I leading by example, am I encouraging and creating an environment for them to work collaboratively?

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Appendix A

Timeline of Main Events Related to Woodard and the Graduate Program at Howard University.

1867	1876	1881	1895	1900	1903	1906	1907	1907 - 1914	1917
Howard University established its Department of Mathematics.	Edward Alexander Bouchet - first african american to earn a PhD. Earned pdh in physics from Yale University	Born on Oct. 3 in Galveston, Texas		Began college at Wilberforce University	Received A.B. from Wilberforce University	B.S. from University of Chicago	M.S. from University of Chicago	Taught at Tuskegee Institue for seven years	
		Father worked for the U.S. Postal Service			WEB Du Bois taught summer school at Tuskegee			Negro progress in a Mississippi Town published 1909	
			Elbert Frank Cox born in Evansville, ID					Practical Arithmetic published in 1911	Cox Recieved BS from indiana University
								The Teaching of Geometry at Tuskegee published in 1913	

1914 - 1920	1920	early 1920	1920-1929	1925	1927	1928	1929
Taught at Wilberforce University for six years	Joined the faculty at Howard University	Took advance math course during the summer session at Columbia University Columbia 1920 Summer Session Catalog	Dean of the College of Arts and Sciences at Howard University Source: https://hdl.handle.net/2027/mdp.39015006964129?urlappend=%3Bseq=95 https://hdl.handle.net/2027/mdp.39015006964129?urlappend=%3Bseq=95	Elbert Cox received PhD from Indiana University	Took scholarly leave from Howard, spent a year at Penn to finish dissertation	PhD from University of Pennsylvania, July 28, 1928	established the M.S. program at Howard Time at Howard
		"During this time he became recognized as one of the gifted mathematicians in the nation."	https://hdl.handle.net/2027/mdp.39015006964129?urlappend=%3Bseq=219			These: On Two-Dimensional Analysis Situs with Special Reference to the Jordan Curve Theorem, Advisor: John R. Kline	Established the mathematics library at Howard
						Becomes the second African American to receive a PhD in Mathematics	Attracted Elbert Cox to join the Faculty at Howard
						he was the 38th person to receive a PhD from University of Pennsylvania	established and sponsored several other professorships and scholarly seminars in mathematics

	1947	1965	1967	1976	1980
	Retired from Howard	Passed away, may he rest in peace	William Claytor passed away while still working at Howard	1976: Howard University establishes the first PhD program in mathematics at a historically black college or university under mathematics department chair James Donaldson and professor J. Ernest Wilkins Jr	The Claytor Lecture – now Claytor-Woodard Lecture – is established at MAA.
	William Claytor accepted a job at howard				

Appendix B

Dudley Weldon Woodard CV

Dudley Weldon Woodard

Birth: October 3, 1881
Galveston, Texas

Education:

Elementary-	Galveston, TX		
Secondary-	Galveston, TX	Graduated 1899	
Collegiate-	Wilberforce, Univ.	1900-03	S.B., 1903
	University of Chicago	1906*	S.B., 1906
		1907	
	University of Pennsylvania	1906-07*	S.M., 1907
	University of Pennsylvania		Ph.D., June 1928

* Three summer quarters were spent at the University of Chicago in undergraduate work. Four summer sessions and one full academic year were spent at the University of Pennsylvania.

Title of Master's Thesis: "Loci Connected With the Problem of Two Bodies"

Title of Ph.D. Dissertation: "On Two-Dimensional Analysis Situs with Special Reference to the Jordan Curve-Theorem"

Pre-Howard Employment:

1907-14	Head, Math Department, Tuskegee Institute, Tuskegee, AL
1914-20	Professor of Mathematics, Wilberforce Univ., Wilberforce, OH

Howard Employment:

1920	Hired as Professor of Mathematics
1920-29	Professor of Mathematics/Dean of the College of Liberal Arts
1929-43	Professor of Mathematics

Dudley Weldon Woodard continued

Howard Employment:

1943-47 Professor of Mathematics, Head of Department of Mathematics
June 30, 1947 Retired, Professor of Mathematics Emeritus

H.U. Sabbaticals:

1927-28

Membership in Professional Organizations:

The American Mathematical Society
Mathematical Association of America
American Asso. of University Professors

Appendix C

Howard University 1928-1929 Catalog: The Graduate Division

GENERAL INFORMATION

ADMISSION

Any person, who is a graduate of a college or university on the approved list when the degree was granted, and whose graduate major is in a department approved by the committee for graduate work, may be admitted to the Graduate Division. Admission to the Graduate Division does not imply admission to candidacy for a higher degree. The requirements for admission to candidacy for a higher degree should be noted below.

ADMISSION TO CANDIDACY FOR A HIGHER DEGREE

Until further notice only the degrees of Master of Arts and Master of Science will be given.

Admission to candidacy for the Master's degree shall be valid for not more than three calendar years. Students wishing to be admitted to candidacy should secure an admission blank from the Chairman of the Committee on Graduate Study. The applicant must have chosen a suitable problem for a thesis subject, with the approval of the major professor.

The applicant must submit a list of the undergraduate courses taken in the field of his graduate study, and a list of graduate courses completed, now being taken, and yet to be pursued, in the field of his graduate study.

RESIDENCE REQUIREMENT

No student will be recommended for a degree who has not spent at least one year (three quarters) in residence at Howard University. The period of residence need not be continuous. Various factors may make it necessary for a candidate to spend more than three quarters in study for the Master's degree.

COURSE REQUIREMENTS

The minimum requirement for the Master's degree is eight courses, for which graduate credit is given, and a thesis. At least five of these courses shall be numbered 200 or above. Various factors may make it necessary for a candidate to take more than the minimum number of courses before he satisfactorily completes the requirements for the degree. Fulfilment of the course requirement cannot be satisfied by correspondence courses, nor

may the minimum requirement of eight courses be reduced by advanced credit from other institutions.

The election and prescription of courses are determined, with the approval of the committee, by the department in which the student is pursuing his degree. (See special requirements of individual departments.)

No courses will be credited toward the fulfilment of the requirements for the degree that were pursued more than five years previous to the quarter in which the student presents himself for the final examination for the degree.

No courses may be presented in fulfilment of the requirements of the degree which the student has not passed with a grade of "B" or better. Courses in which the student receives a grade of "C" or lower will, however, be entered upon his record. Any candidate for a degree, who receives credit of "C" or lower in four courses, will be withdrawn from candidacy.

THESIS REQUIREMENT

Each candidate for a Master's degree must submit a thesis in partial fulfilment of the requirements. The candidate will be assigned to a professor in and by the department in which he is pursuing his graduate study. This professor will act as his adviser in the preparation of his thesis and in the election of his graduate courses.

The subject of the thesis should be selected as early in the course as possible, preferably before the end of the first quarter of residence.

The student should acquire an understanding of, and ability to use, the elementary technique of research in his field of study. He should show ability to present clearly and effectively the results of his or other investigations in his field.

The thesis shall be typewritten upon twenty-pound paper, 8½ x 11 inches and should be double spaced. Two copies, the original and first, shall be deposited with the Chairman of the Graduate Committee not later than two weeks before the date of the final examination for the degree.

Five typewritten abstracts of the thesis of not more than six hundred words, shall be submitted to the Chairman of the Graduate Committee

HOWARD UNIVERSITY

Title

A Dissertation Submitted to the
Faculty of the Graduate Division of
Howard University

in Partial Fulfillment of the
Requirements
for the Degree of

(Master of Arts)

(Master of Science)

Department of.....

by

(Student's Name)

Washington, D. C.

(Date)

not later than two weeks before the final examination for the degree. These abstracts shall include a brief summary of:

The problem

Methods of procedure

Summary of results

Conclusions

Contributions

The title page of the thesis shall be prepared in accordance with the form on the following page.

FINAL EXAMINATIONS

A candidate for the Master's degree is required to take an oral examination which is the final test of his fitness for the degree. This examination is administered by the Graduate Committee and the department concerned. It consists of a comprehensive test in the courses offered by the student in candidacy for the degree and includes specifically a test of his grasp of the technique of research in that field.

Any candidate who fails in the first examination may be allowed a second examination, provided it does not come earlier than one quarter from the date of the previous examination, and the application for the second examination bears the approval of the department in which the student is specializing.

No thesis will be accepted that is not written in clear, effective, and correct English.

FEES (subject to change without notice)

All students who are entering the University for the first time are required to pay a matriculation fee of \$5.00.

The graduation and diploma fee is \$7.50. An additional fee of \$4.00 is charged for the binding of the two copies of the thesis.

The incidental fee is \$46.67 a quarter payable in advance.

Students seeking admission to the Graduate Division should request an application blank from the Chairman. To expedite the consideration of an application, a transcript of the applicant's high school and college records, and any other written evidence showing the applicant's ability to profit by graduate study should be sent promptly with the application.

FELLOWSHIPS AND SCHOLARSHIPS

A limited number of fellowships and scholarships are available for students pursuing graduate study. Fellowships are generally awarded to research assistants.

Students may make application by filling out an application blank obtainable from the Chairman of the Committee. The award of a fellow-

ship is made by the Trustees upon the recommendation of the Committee and the approval of the department in which the student is doing his graduate study.

Holders of fellowships are not allowed to engage in any work, outside of their duties as fellows, except upon written approval of the Committee.

Fellowships and scholarships are awarded for one year (three quarters) only. Continuance or renewal of a fellowship will be made only upon specific recommendation of the Committee based upon the approval of the department in which the student is doing his work.

Appendix D

Howard University 1919-1920 Catalog: Graduate Work

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THE COLLEGE

GRADUATE WORK

The University offers under the administration of an interdepartmental committee on graduate studies, several courses of post-graduate work leading to the degree of Master of Arts or Master of Science.

For the present, five fields or programs of post-graduate work are offered: (1) in Biological Science, (2) in Comparative Literature, (3) in History and Culture of the Negro, (4) in Education, and (5) in Theology. The supervision of the candidate's work and the administration of these courses are placed under the Committee on Graduate Studies.

Students who have already received the Bachelor's degree from this or other colleges of recognized standing will be admitted to candidacy for the Master's degree. In addition, they must satisfy the committee that such antecedent studies have qualified them for profitably pursuing the subjects selected for graduate work.

At least one year of residence in this University is required for the degree. The student must follow an approved program of work consisting of a minimum of eight courses and a thesis upon an approved topic. The subject of the thesis must be determined as early as possible during the candidate's first quarter of study, and the thesis must be submitted not later than two months before the granting of the degree.

Candidates for the degree will be required to have a reading knowledge of French or German.

An oral examination embracing topics in the general field of the candidate's work is required in addition to the course examinations.

Candidates for the Master's degree will be charged the usual matriculation, incidental, and laboratory fees. They will also be charged \$50 for tuition for the course and the fee of \$25 for graduation and diploma.

No work credited for the Master's degree can be credited toward any other degree given by the University.

GRADUATE WORK

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All correspondence and applications for admission to candidacy for the Master's degree should be addressed to the chairman of the following committee:

The Dean of the School of Liberal Arts, Chairman.

The Dean of the School of Religion.

The Dean of the School of Education.

Professor Ernest E. Just.

Assistant Professor Alain L. Locke.

Appendix E

William Schieffelin Claytor's first publication in the *American Mathematical Monthly* in 1929

SOLUTIONS

3334[1928, 377]. *Proposed by James Singer, Graduate College, Princeton, N. J.*
Evaluate

$$\lim_{n \rightarrow \infty} \left[\frac{1}{2^n} \left(\sum \frac{e_1}{2^{2 \cdot 1 - e_1}} + \frac{e_2}{2^{2 \cdot 2 - (e_1 + e_2)}} + \cdots + \frac{e_n}{2^{2n - (e_1 + e_2 + \cdots + e_n)}} \right) \right],$$

where $e_i = 0$ or 1 , and the sum is extended over all possible choices of the e 's; i.e., the sum of the n terms where all the e 's except one are zero, plus the $n(n-1)/2$ terms where all the e 's except two are zero, \cdots , plus the single term where all the e 's are unity.

Solution by Schieffelin Claytor, Washington D. C.

It will be convenient to find first the sum of all the r th terms for a given n , where $e_r = 1$, i.e., the sum of all the terms $1/2^\rho$, where $\rho = 2r - (e_1 + e_2 + \cdots + e_{r-1} + 1)$. For a given set of values for $e_1, e_2, \cdots, e_{r-1}$ this term will occur 2^{n-r} times. Also if K is an integer, $0 \leq K \leq r-1$, there are ${}_{r-1}C_K$ ways of choosing unit values for the e 's so that $e_1 + e_2 + \cdots + e_{r-1} = K$. Hence the sum of all the r th terms is

$$\sum_{K=0}^{r-1} \frac{2^{n-r} {}_{r-1}C_K}{2^{2r-K-1}} = 2^{n-2r+1} \sum_{K=0}^{r-1} 2^K {}_{r-1}C_K = 2^{n-2} \left(\frac{3}{8} \right)^{r-1}.$$

Taking the sum of the above results for $r=1, 2, \cdots, n$ and dividing this sum by 2^n , we have

$$\frac{\frac{1}{4} \frac{1 - \left(\frac{3}{8}\right)^n}{1 - \frac{3}{8}}}{\frac{1}{5} \left[1 - \left(\frac{3}{8}\right)^n \right]} = \frac{2}{5} \left[1 - \left(\frac{3}{8}\right)^n \right].$$

and hence the desired limit is $2/5$.