

I've Got the Power: Representations of Mathematical Skills and Abilities within Popular Movies about Successful Hip Hop Musicians

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This study employed a positive deviance framework to analyze popular movies (n=8) presenting language of schooling narratives about Hip Hop musicians achieving success, so as to determine if the messages disseminated in the movies supported or refuted the heuristic notion that teachers and parents tell children: "You need math skills to get a good job." Eight selected movies were analyzed, and each was coded for references to mathematics (including numeracy, numbers, or statistics); then coded data was tabulated to determine any patterns in support or refutation of the importance of mathematical skills and abilities to succeed in a Hip Hop career according to the narratives presented within these movies. The discussion and conclusions sections of this paper examines the significance of these findings for developing programs and pedagogy that positively impacts adolescents' perceptions of mathematics, and their attitudes toward mathematics-related careers such as the science, technology, engineering, and mathematics (STEM) fields.

Keywords: minorities and mathematics, Hip Hop music and culture, language of schooling, entertainment-education (edutainment), positive deviance.

This empirical study of multimedia content analyzed representations of mathematical skills and abilities as portrayed within movies about success in Hip Hop's rap music industry. We define success in the context of this study as achieving notoriety and mutual respect from peers and members of the Hip Hop community. The study was undertaken as part of a broader line of inquiry addressing the impacts of popular media—also called pop media or mass media—upon adolescent-aged youth; popular media has been shown to convey and reinforce cultural values that play a remarkable role in defining which behaviors and roles are considered desirable versus undesirable (Long, Steinke,

Applegate, Lapinski, Johnson, & Ghosh, 2010; Rushkoff, 1999; Steinke, 2005). Previous studies have analyzed the images of STEM and STEM-professionals within children's educational science programs in the United States (Long & Steinke, 1996), the cultural representations of scientists and engineers in popular movies (Steinke, 2005), as well as the portrayals of male and female scientists in television programs popular among middle school-age children (Long, et al., 2010). Within the context described, this paper presents findings generated from a comparative case study analysis of eight movies about succeeding within Hip Hop music that were identified from a positive deviance framework (Dura & Singhal, 2009), so as to address the principal research question: What lessons and implications can be drawn from the movies relevant to the development of programs and pedagogy inspired by Hip Hop culture, aimed at creating positive impacts on adolescents' perceptions of mathematics and their attitudes toward mathematics-related careers in STEM fields?

Historically, intersections between Hip Hop culture and K-12 education have been studied from several perspectives including sociolinguistics, critical theory and pedagogy, as well as across ethnographic research approaches. For example, Smitherman's "The Chain Remain the Same: Communicative Practices in the Hip Hop Nation" (1997) published in the *Journal of Black Studies*, examined the linguistic practices inherent in rap music and "rooted in the Black oral tradition of tonal semantics, narrativizing, signification/signifyin, the dozens/playin the dozens, Africanized syntax, and other communicative practices" (pg. 4). A year later, the journal of *Patient Education and Counseling* published a mixed-methods study examining a model for using Hip Hop music during small-group HIV/AIDS prevention counseling serving African-American adolescents and young adults (Stephens, Braithwaite, & Taylor, 1998). However, it was not until 2001 when Greg Dimitriadis ethnographically triangulated pedagogy and identity with Hip Hop text in *Performing Identity/Performing Culture: Hip Hop as Text, Pedagogy, and Lived Practice* that Hip Hop as an indigenous form of pedagogy began to take root in the field of educational research.

Dimitriadis's seminal study, and Hill's continuation *Beats, Rhymes, and Classroom Life: Hip Hop Pedagogy and the Politics of Identity* (2009), introduced Hip Hop Based Education (HHBE) as a field of critical ethnographic research in education. Pedagogy that incorporates Hip Hop music and culture, which we refer to in this article as Hip Hop-based pedagogy, has contributed a wide-range of published research about the cross-connections between Hip Hop, schooling, methodology, and ideological perspective. Some of the illustrative exemplars include an article by Morrell and Duncan-Andrade (2002) which examines the employment of "engaging Hip Hop culture" (p. 88) to promote academic literacy with urban youth. "Rap as literacy" was later examined by Newman (2005), whose study emphasized the analysis of Hip Hop ciphers (i.e., round-robin style group rhyming). As far as the connection of Hip Hop pedagogy with science, the foremost scholarship is the work of Emdin

(2010), entitled *Urban Science Education for the Hip Hop Generation*, which will be discussed extensively later in this paper in terms of implications for connecting Hip Hop pedagogy with math instruction.

One of the foremost in-depth qualitative explorations on the topic of the intersections between Hip Hop, education, and pedagogy was disseminated via J. Wilson's doctoral dissertation (2007; in press as a book), which examined the *language of schooling* and education in the southern Hip Hop community of practice. Presented as a precursor to understanding the pedagogical foundations of Hip Hop culture, Wilson conducted an ethnographic content analysis in order to describe what she refers to as the language of schooling as appearing in rap lyrics and related interview narratives. Her methodological and conceptual decisions rested on the notion that practitioners and researchers interested in applying Hip Hop's best practices in learning environments, both formal and informal, needed to know first *what* the community of practice thought about schooling as place, pedagogy, and philosophy as well as *how* they socially engaged in pedagogical performance.

Building upon previous literature, the research study presented in this original paper employed a positive deviance framework to analyze popular movies ($n=8$) which contain language of schooling narratives about Hip Hop musicians' achievement of success. A cursory search on website www.rapgenius.com of "mathematics" as a keyword in rap lyrics returned sixteen songs (retrieved from <http://rap.genius.com> on 2015, December 2). Our goal, however, was to examine narrative data rather than strictly textual data to ascertain if the messages disseminated in the movies support or refute the heuristic notion teachers and parents tell children about the usefulness of math skills for getting a good job. Therefore, half of the movies selected for analysis were fictionalized biographical accounts of real-life successful Hip Hop musicians, while the other half of the movies chosen were documentary movies about musicians. The objectives of the study were as follows: (1) to determine, through empirical analysis, what values are displayed about schooling in general, whether explicitly or implicitly, during the portrayal of mathematics in Hip Hop culture; (2) whether these values affirm mathematics as a necessary skill or form of knowledge to succeed; and (3) whether discrete notions presented via role models or encouraged behaviors in Hip Hop culture confirm or refute the heuristic notion advocated by parents and teachers, namely that: "You need math skills to get a good job."

This study was pursued with the intention that the results of this analysis would help mathematics educators in their efforts to improve the pedagogical impact of mathematics instruction. Within this context, the eight movies were selected for content analysis with regards to messages about mathematics, and the value or desirability of mathematics within narratives that were either non-fictional documentaries or fictionalized accounts of real-life Hip Hop artists. All of the movies analyzed presented a multimedia-based narrative about Hip Hop culture and success within that culture, and specifically with regards to

aspirations at a professional musical career within the Hip Hop genre. Within the research context described, this study was conducted employing a combination of learning theories adopted from entertainment-education theory, positive deviance theory, and multimedia learning theory. The next section of this paper will discuss the integration of these learning theories into a coherent framework for undertaking the original research study described in this paper.

Conceptual Framework

Entertainment-education, defined as “the intentional placement of educational content in entertainment messages” (Singhal & Rogers, 2002), is also sometimes abbreviated as E-E or referred to as edutainment. *Edutainment* is also the title album from Hip Hop rapper Lawrence “Krisna” Parker, who is known in Hip Hop’s community of practice as “KRS-One.” Released in 1990, the album evokes the language of schooling concept through its title but also in the ways in which it intersects socio-political messaging about Blackness over sonically-pleasing beats. As employed by both Parker (1990) and Singhal and Rogers (2002), edutainment as a framework remains a learning strategy operating within the epistemology of constructivism, as opposed to a full learning theory (Brown & Singhal, 1990) and has successfully been implemented to address a vast range of problems including adult illiteracy, child undernourishment, and domestic violence in many countries, including Japan, Mexico, Thailand, India, and the Philippines (Kim et al., 2009; Rogers & Singhal, 1989; Singhal, 2007; Singhal, Rattine-Flaherty, & Mayer, 2010; Sthapitanonda, Buaparakorn, & Singhal, 2005).

The goal of entertainment-education is simple in theory; it involves combining educational content into an entertaining form in a context audiences can learn from while simultaneously enjoying the experience (Singhal & Rogers, 2002). While there may not be a standard formula for the content of entertainment-education productions, there are a limited set of formats in which entertainment-education media is generally produced. These formats include: (a) documentaries of assorted genres, with examples including *An Inconvenient Truth* or *March of the Penguins*, (b) children's programming, such as *Barney & Friends* or *Sesame Street* (c) media aimed at teenagers in an attempt to ward off destructive behavior, such as commercials discouraging texting while driving, and (d) instructional programming, such as *The Joy of Painting* with Bob Ross or Bob Villa’s *This Old House*.

A positive deviance framework is, by definition, a process that identifies and duplicates successful solutions, despite the solutions being different from the norm (Singhal, 2013). The positive deviance framework is built upon the idea that “there are certain individuals or groups whose uncommon behaviors and strategies enable them to find better solutions to problems than their peers, while having access to the same resources” (Singhal, 2013; p. 5). These more desirable solutions can be replicated or transferred to other settings by directed

study and analysis. It is important to note that a positive deviance framework allows recognition of productions that “are ordinarily invisible to others,” even those within the same community (Singhal, 2013; p. 5). A positive deviance approach thus “enables communities to self-discover the positively deviant behaviors amidst them, and then ... amplify them” (Singhal, 2013, p. 6). It is also essential for these communities to see the atypical behaviors identified via a positive deviance framework as exemplars of cultural resilience rather than as forms of negative deviance, which implies moral incorrectness (Wilson, 2016), and this is particularly important in the effort to change current practices within the formal, and oftentimes inherently traditional, mathematics classroom.

The present study examined multiple examples of successful entertainment-education media that were met with low resistance. The positive deviance framework, when considered from a perspective of relevancy and resilience, provides a look into what allowed these exemplars to be successful, and this is done in the hopes of replicating or transferring these aspects to other media efforts. However, despite the solid foundations in theory of an entertainment-education system, surveys relating to uses of media reveal that many, if not most, entertainment-education programs are met with substantial resistance. As a result, these productions have often failed to make as great an impact as originally intended by the producers (Carr, 2011). It is the overall historical lack of extensive impact resulting from edutainment programs which has led the scholarship community of entertainment-education media researchers to strive to find reliable methods for generating high-quality productions that successfully compete with all other media genres in order to reach audiences.

A positive deviance framework allows identification of case studies in entertainment-education that have successfully captured the attention of their audience within a certain media. Included within the positive deviance framework is an explicit recognition that one of the primary identified obstacles to achieving successful entertainment-education productions is that the products will need to compete within a general media marketplace, not just the confines of a hypothetically isolated and monitored schoolhouse, in order to be successful. Therefore a positive deviance framework has been used in the current study to conduct an analysis of the representation of mathematics within movies about successful Hip Hop musicians. The pedagogical use of entertainment-education strategy gathers from learning theories such as social cognitive theory, social learning theory, social constructivism, dramatic theories, and diffusion of innovations (Singhal & Rogers, 2002); this is in addition to an entertainment-education ethical framework (Brown & Singhal, 1990; Papa et al., 2000). Scholarship within this framework over the years has been able to build upon these theories and incorporate them into entertainment-education learning.

Employing a positive deviance framework, the eight movies studied in this paper were chosen for having met several criteria: (1) they each achieved the definition of an entertainment-education production—"intentional placement of educational content in entertainment messages" (Singhal & Rogers, 2002)—in that they included semi-fictionalized biographical accounts of the experiences of successful Hip Hop musicians as they arose in the music industry as the content for narratives, (2) they have each reached a substantial number of viewers, and (3) they each focused on the lives of real Hip Hop musicians. Within the context described, this paper presents findings generated from a comparative case study analysis of the eight selected movies about succeeding within Hip Hop music that were identified from a positive deviance framework (Dura & Singhal, 2009), so as to address the principal research question: What lessons and implications can be drawn from the movies relevant to the development of programs and pedagogy inspired by Hip Hop culture, aimed at creating positive impacts on adolescents' perceptions of mathematics and their attitudes toward mathematics-related careers in STEM fields?

Research Methods

Data Selection

A positive deviance framework was employed to identify movies that presented narratives focused on actual real-life musicians that had succeeded within the Hip Hop music industry (as opposed to movies about purely fictional musicians). A total of eight movies were analyzed: the non-fiction movies *Nas: Time Is Illmatic* (2014, dir. One9), *Tupac Resurrection* (2003, dir. Lauren Lazin), *Wu: The Story of the Wu-Tang Clan* (2007, dir. Gerald Barclay) and *Jay-Z: Fade To Black* (2004, dir. Patrick Paulson & Michael John Warren), and the fiction movies *Notorious* (2009, dir. George Tillman, Jr.), *Hustle & Flow* (2005, dir. Craig Brewer), *Get Rich or Die Tryin'* (2005, dir. Jim Sheridan) and *8 Mile* (2002, dir. Curtis Hanson). Table 1 presents an overview of each of the movies analyzed.

The fiction movies selected were narrative representations of various real life artists' lives and careers (i.e., Christopher "Biggie Smalls" Wallace, Marshall "Eminem" Mathers, and others), with a general narrative emphasis upon their rise to fame; their relationship to school, including whether they graduated or dropped out, and how business relationships began in school-based social networks); and their specific pathways to success. The non-fiction movies were documentaries about the careers of Hip Hop artists or groups (i.e., Tupac "2Pac" Shakur, Shawn "Jay-Z" Carter, and others) often emphasizing previously recorded live concert footage interspersed with recording sessions, footage about the role of school in their creative and artistic development, and with data often coming via the song lyrics presented during the movies' narratives.

Table 1
Overview of Information about Movies Analyzed

<i>M#</i>	<i>Movie Title</i>	<i>Release Year</i>	<i>Features / Nickname</i>	<i>Genre</i>	<i>Director</i>	<i>Runtime Minutes</i>	<i>Budget (Box office)</i>
M1	8 Mile	2002	Marshall Mathers III / "Eminem"	fiction	Curtis Hanson	110	\$41 million (\$243 million)
M2	Tupac: Resurrection	2003	Tupac Shakur / "2Pac"	non-fiction	Lauren Lazin	111	\$300,000 (\$8 million)
M3	Jay-Z: Fade to Black	2004	Shawn Carter / "Jay-Z"	non-fiction	Patrick Paulson & Michael J. Warren	109	< \$200,000 (\$730,000)
M4	Hustle & Flow	2005	Derrick Hill / "Kingpin Skinny Pimp"	fiction	Craig Brewer	116	\$2.8 million (\$23.6 million)
M5	Get Rich or Die Tryin'	2005	Curtis Jackson III / "50 Cent"	fiction	Jim Sheridan	117	\$40 million (\$46 million)
M6	Wu: The Story of the Wu-tang Clan	2007	Robert Diggs / "RZA"	non-fiction	Gerald Barclay	79	< \$200,000 (unknown)
M7	Notorious	2009	Christopher Wallace / "Biggie Smalls"	fiction	George Tillman, Jr.	123	\$20 million (\$44.4 million)
M8	Nas: Time Is Illmatic	2014	Nasir Jones / "Nas"	non-fiction	Michael "One9" Silverman	74	< \$200,000 (\$165,000)

Data Analysis

The sources for the data were DVDs of the movies. They were watched and coded for any reference to numbers, mathematics or statistics; each reference was noted (written down), along with its speaker and the time at which it occurred in the movie (h:mm:ss). Data analysis was complemented by a grounded theory approach employing "systematic, yet flexible guidelines for collecting and analyzing qualitative data" with the goal of "construct[ing] theories grounded in the data themselves" (Charmaz, 2006, p. 2; Corbin & Strauss, 2008). Within a grounded theory approach, the data coding method employed was the constant comparative method, wherein: (1) qualitative data

were compared case by case while generating flexible categories and integrating additional cases into the categorization schematic, (2) the qualitative data categorization was then refined based on responses to check the orientation that each piece of data indicated, and (3) once the meta categories were determined and the subsets saturated, the remaining qualitative data were coded utilizing those categories that had been previously developed by the research team (Glaser, 1978).

Each movie was coded for any references that were mathematical in nature. Next, these qualitative data were analyzed using the grounded theory method of axial and selective coding (Strauss & Corbin, 1994). Qualitative data were coded according to their ability to provide insight regarding the primary research questions of this study, namely an empirical determination of the messages portrayed within these movies about mathematical skills and ability. After the major subthemes were determined, these variables were the main categories that were used as a means of rough sorting relevant quotes and other qualitative data obtained from the movies. The axiom for the selection of these categories was data frequency, meaning that any theme that would appear more than one time in the data would justify a category. Some categories were present in each movie, whereas others occurred more sporadically. A “Miscellaneous” category was kept that comprised the outliers, defined as anything that was a single occurrence (i.e., usually matters of simple enumeration or colloquial expression) not fitting into a category and not warranting the creation of a new one; as such, “Miscellaneous” category data was not used for further data compilation or analysis.

The results were then transcribed and tabulated into two Excel spreadsheets, one compiling data for the non-fiction movies and one for the fiction movies. During open coding, nine subthemes emerged. These subthemes, along with archetypal concrete examples of each subthemes from the movies, are displayed in Table 2.

Results

The nine subthemes that emerged from the open coding of the data were: time, drugs/alcohol, weapons/crime, money/possessions/status, designations (of people, places, and products), mathematics *per se*, school/education, accomplishments (not music-related), and geography. The remainder of this section discusses an overview of the specific symbolic and representational relationships presented in the movies analyzed, and includes noteworthy findings obtained from the data analysis of each of these subthemes.

Table 2
Subthemes that Emerged during Open Coding

<i>Emergent Subthemes</i>	<i>Examples from Movies</i>
Time	<ul style="list-style-type: none"> • Timeline benchmarks • Duration of events
Drugs/alcohol	<ul style="list-style-type: none"> • Quantities of alcohol • Specifics about drugs
Weapons/crime	<ul style="list-style-type: none"> • Details of crime • Types of weapons
Money/possessions/status	<ul style="list-style-type: none"> • Types of vehicles owned • Amounts of money • Specifics about property
Designations (of people, places, and products)	<ul style="list-style-type: none"> • Albums sold • Radio stations • DJ names • Song and album names
Mathematics per se	<ul style="list-style-type: none"> • Conversation of statistics • Science discussions
School/education	<ul style="list-style-type: none"> • Schools attended • Grades received • Experiences with teachers, etc.
Accomplishments (not music-related)	<ul style="list-style-type: none"> • Trophies won • Sports accomplishments • Partners dated
Geography	<ul style="list-style-type: none"> • Street numbers • Areas codes • Zip codes • Phone numbers

Time: Discussions and references to time were a consistent theme in all movies analyzed, with a minimum number of references in *Hustle & Flow* ($n=7$) and a maximum number of references in *Tupac: Resurrection* ($n=22$). Data in this field is made up of static time elements, such as dates, time of the day, and age, as well as elements of duration. Information explicitly about time was more prevalent within the documentary movies, and perhaps this is due to the generally chronological nature of the non-fiction movies analyzed. A brief numerical and contextual analysis of discussions about character's ages shows an emphasis upon issues relevant to youth, such as running away from home early in life, dropping out of school before graduation, or losing a family member at an early age due to divorce or death. Furthermore, references to time can mostly be divided into discussions about time as a limited quantity (e.g., limited time to perform in rap battles, limited life expectancy in gang life, limited time to earn money quickly, or limited time to get a career in music underway) versus discussions about time where lengthy durations of time are a burden (e.g., lengthy time spans spent in school, or lengthy time spans that

could be wasted during a potential prison sentence). As such, these elements of time duration often become symbolic of the harsh realities of achieving success within the notoriously ruthless Hip Hop music business, and often emphasize the differing perceptions of time's passage that such a life incurs when compared to the monotony of the "daily grind" incurred while working a standard "9-to-5" job.

Drugs/alcohol: Numerical occurrences in this category often refer to alcohol, drugs, paraphernalia for drug-use, or the drug trade. References include items such as "crack open a forty" (i.e., referring to individual beer bottles that contain forty ounces of liquid), "eight-balls" (i.e., referring to a mixture of cocaine and heroine), and "two dimes" (i.e., referring to a specific quantity of marijuana). While comparatively sporadic among the movies when contrasted with some of the other more prominent subthemes, nonetheless these references to drugs and alcohol were often made in association with guns and money, and were sometimes employed as symbols of the gang life that all eight main protagonists in the movies dealt with at some point in their respective narratives. However it is noteworthy that none of the eight main characters actually use hard drugs on camera in any of the movies, and drug addicts were consistently negatively portrayed without any glamorization (e.g., the crack-cocaine addicts portrayed in *Hustle & Flow*). Contrary to drug-use or addiction, profiting from the drug trade was consistently portrayed as a reasonable alternative to staying in school or getting a menial job, in that selling drugs—according to the movies' narratives—usually entailed earning more money than an entry-level job, required more entrepreneurial spirit than working for a boss, and also necessitated obtaining weaponry for self-defense and enforcement of rules. For these reasons, drug-dealing within these movie narratives was steadily portrayed as a valid option for those who chose to participate in the illegal activity because they believed more socially legitimate options for achieving success were not available to them.

Weapons/crime: The subtheme of numbers pertaining to weapons/crime was explicitly mentioned in every movie with the exception of one (i.e., *Wu: The Story of the Wu-tang Clan*). Occurrences in this category include echoing of police-related expressions (e.g., K9, dispatch codes like "187" for murder, reference to police as "Five-Oh"), as well as jail sentence enumerations or other punishment-related tabulations (e.g., number of felonies on personal police-record, number of arrests, fines for speeding above limit, or consequences of violence such as amount of blood spilled). Other data in this field refers to specifications of weapons, such as caliber (e.g., "Glock 9"), types of ammo (e.g., "45 ACP"), and on occasion the number of times that an artist was shot and lived to tell about it (e.g., 50 Cent was "shot nine times" and survived) or the number of times an artist was shot when they were assassinated (e.g., Tupac was shot with "four bullets" and subsequently died). It should be noted that while the data in this field was relatively frequent, it lacked homogeneity in that it was comprised primarily of outliers that were mentioned only one time.

Possessions/money/status: Monetary amounts and references were a primary component of this subtheme. References to money included those in regarding record contracts or drug deals, as well as business opportunities. Data from this subtheme also occasionally referred to actual paper money bills, as in a scene during a robbery (e.g., “Where the hundreds at?”) or wealth status (e.g., “My cup runnin' over with hundreds!”). It should be noted that the term “free” is also included in this category (e.g., use for “free studio time,” or performing without payment to obtain exposure). Monetary quantities mentioned were also occasionally related to the legal world, and in these cases often refer to the amounts of lawsuits or bail bonds (often as a marker of status within gang life). Discussions about vehicles in this category included car models (i.e., Mercedes S-500), and size of the vehicle’s wheels (i.e., “22-inch rims”). These references were often employed to represent marks of status through possession (i.e., owning a luxury car), or customized stylization of vehicular possessions. Some other references discussed material possession other than money, such as brand-name fashions (e.g., Chanel boots) or expensive liquor (e.g., Remy Martin cognac). Within the eight movies analyzed there were only two occurrences of discussing expenditures of monetary amounts representative of a “regular” life (e.g., one of these references was to a minimum-wage salary and the other was a debate about paying the rent). More often, money was in relation to discussions about the music industry or musical products. Data in this subtheme often referred to chart performance, such as having a “#1 hit,” or selling earmarked quantities of records that correspond with “gold” and “platinum” status within the music industry lingo. It also could refer to ability, such as Jay-Z’s talent for rapping directly from memory without writing anything down (e.g., Jay-Z performing “thirty raps from his head”). Sporadically, numerical references were in relation to music itself, such as a scene in *Jay-Z: Fade to Black* about beat counts that included a brief discussion by Pharrell Williams on the topic of the tonal qualities within 7th chords.

Designations (of people, places, and products): Data in this field included several occurrences mentioning the inaugural Wu-Tang Clan album produced by RZA, entitled *Enter the Wu-tang: 36 Chambers*. This category also included references to numbers in designations, such as those that referred to particular radio stations (e.g., “Q107”), or the nicknames belonging to rappers or their DJs (e.g., “KRS-One,” “2Pac,” “50 Cent”).

Mathematics per se: Data in this category included any depictions of mathematics as such, for example a scene in *Notorious* during which a young Christopher “Biggie Smalls” Wallace is sitting in a classroom while a teacher discusses math to the group of students. Likewise, any mentions of scientific knowledge that was mathematical, abstract mathematical thinking, or straight statistics (e.g., *Hustle & Flow* mentioned that Hip Hop is a “one in a million shot”) was also included in this subtheme. The math classroom scene in *Notorious* was especially revealing and poignant to this article’s topic, in that the movie celebrated Christopher Wallace’s choice to verbally ridicule his math

teacher in front of the class by arguing cogently that a garbage man makes more money than a teacher. There are also several occurrences in the documentary *Wu: The Story of the Wu-tang Clan* during which the narrative presented mathematical ideas and concepts about topics such as chess and kung-fu that corresponded to Robert “RZA” Diggs’s individual brand of numerical-mysticism that has consistently remained a prominent theme amongst the Wu-tang Clan’s lyrics. The true meaning of the album title *Enter the Wu-tang: 36 Chambers* has been debated. A prominent theory states that the number “36” is a nod to the kung-fu movie entitled *36th Chamber of Shaolin* (1978), but another (or perhaps overlapping) explanation details how there are nine members of the group—nine being a number representing existential completion according to the Five Percent philosophy called *Supreme Mathematics* (Miyakawa, 2005)—and each member has four heart chambers, therefore their total equaling 36 chambers (9 times 4).

School/education: Data in this field includes references to grade-levels in school, mentions of teachers and school administrators, narratives about schooling experiences, numerical grades received in school, enumeration of school-related rules, education-themed quantities presented within the narratives such as classes taken, and occasionally Biblical-education (e.g., a mention of Psalm 23). Occasionally this category had some commonality with the *mathematics per se* category, such as the earlier discussed classroom scene about a math lesson, in which case the data was assigned to only one subtheme or the other depending on comparative suitability.

Accomplishments (not music-related): Most data for this subtheme occurred in the non-fiction movies, generally during portions of the narratives that recounted the lifetime achievements of their protagonist subject. The fiction movies, which focused chiefly on the nascent stages of their protagonists’ careers, generally did not dwell upon accomplishments that were not music-related.

Geography: It should be noted at the outset of this discussion about geography that the majority of the numerical references to geography occurred in the movie *8 Mile* ($n=22$), which contained more numerical geography references than the other seven movies combined ($n=6$; half of which were in *Tupac: Resurrection*). Occurrences of numerical geography references in the movie *8 Mile* often referred to the titular 8 Mile Road in the city of Detroit, where the movie’s story took place and the rapper Marshall “Eminem” Mather developed his nascent music career. The 8 Mile Road itself, as explained by the movie’s narrative, was a cultural emblem of racial and socioeconomic divisions within the city, in that it separated the affluent, predominantly White northern neighborhoods from the poorer, predominantly Black neighborhoods in the south. This distinction extended to the area codes of 810 and 313, respectively, and by extension, the name of Eminem’s Hip Hop group in the movie is “Three One Third” because they are from the poor southern side of the 8 Mile Road with the 313 area code (in actuality, Eminem’s band was named “D12” which

is an initialism for “The Dirty Dozen”). Another illustration of this type of overlapping identification between numerical geography and group identity occurred in *Hustle & Flow* during a scene where the protagonist (referred to as “Skinny Black” in the movie) described a group of African-American men as the “North Third Thugs” in reference to the avenue number where they live.

Further analysis of the subthemes revealed two meta-themes for establishing a dualistic typology of the emergent subthemes, namely (a) referential or (b) symbolic. These meta-themes were developed based upon the subthemes, and are the topic of the next section about noteworthy findings.

Two chief types of relationships emerged between the movies’ protagonists and the coded numerical subthemes from the data analysis: these were (a) “Referential Relationships” and (b) “Symbolic Relationships.” It should be noted that these two types of relationships were not higher categories of the nine subthemes mentioned above, but were rather meta-categories that allowed typologies of the emergent subthemes to be clarified.

Table 3

Numerical Aspects of Movies about Successful Hip Hop Musicians									
<i>General Themes</i>	<i>Specific Themes</i>	<i>Fiction Movies (n=4)</i>				<i>Non-fiction Movies (n=4)</i>			
		M1	M	M	M7	M	M	M	M8
			4	5		2	3	6	
Referential relationship to numerical components	Time	8	21	15	7	13	19	8	22
	Mathematics <i>per se</i>	--	--	3	1	1	3	--	--
	School/education	1	--	2	3	2	1	1	2
Symbolic relationship to numerical components	Weapons/crime	10	2	12	2	4	--	10	10
	Drugs/alcohol	1	--	--	1	--	2	3	--
	Designations	--	3	1	2	1	1	3	2
	Money/possessions	7	--	11	3	2	4	8	10
	Accomplishments*	2	7	--	--	--	6	4	2
	Geography	--	22	--	2	--	--	1	3

*Accomplishments here refers to those that are not music-related

Analysis of the nine categorical subthemes revealed that references to numerical components in all eight movies fell almost entirely into these two relationships: one where numbers were treated as such (i.e., referential) and stood for a purely numerical idea or thought process, and one where numbers stood for something (i.e., symbolic), either an idea, a symbol, a mark of status, or description of socioeconomic phenomena such as drugs or crimes.

The distribution of the data along these two relationships is presented in Table 3, which combines two tables: one for the fiction movies, and one for the non-fiction movies. The nine subthemes were sorted along these two typologies, and the number of occurrences of the subthemes presented in each

movie was compiled. The distribution of the data within these subthemes is also presented in Table 3.

Discussion

Interpretation of the data, taking into account solely the data's distribution and frequency along the two typology variables, leads to the conclusion that symbolic relationships with numeracy are more prevalent within the Hip Hop movie narratives than referential relationships. The results displayed in Table 3 demonstrated that there were more occurrences of the symbolic relationship type than the referential relationship type within both fiction and non-fiction movies (i.e., 90 to 61 in the fiction movies, 76 to 72 in the non-fiction movies). Although the non-fiction movies were approximately balanced with only four more referential than symbolic numerical references, within this context it is crucial to note that based upon box office receipts (see Table 1) the fiction movies analyzed had viewing audiences several orders of magnitude larger than the non-fiction movies, as well as a 47.5% greater presence of symbolic versus referential relationships.

Furthermore, references of the symbolic kind had greater variety of data subthemes: six of the nine emergent subthemes were determined to be primarily symbolic, whereas only three of the nine emergent subthemes were determined to be primarily referential. With actual referential relationships to numeracy, and therefore the accompanying mathematical reasoning, relatively absent from the fiction movies, the chief conclusion of this study was that these movies about Hip Hop culture presented mathematics and numeracy as a primarily symbolic relationship to the real-world, but less often as a referential relationship worthy of actual mathematical analysis.

In all of the movies analyzed, the consistent themes of choosing between a criminal career versus a musical career ran parallel to each other, and it was a common plot-device of the movies to feature the elements that the two choices have in common with one another. This was frequently portrayed as emphasizing a dualistic matching between record deals with drug deals, with corresponding success dependent upon years of relevance and years in power. Likewise, the plot-points of betrayal, pitfalls from success, tenuous relationships with institutionalized schooling, hardships that must be endured, and the extreme value placed upon reputation and status, were other concepts that the movies tended to echo as similarities between the criminal versus musical career options.

With most numerical references becoming symbolic of gang life or musical careers, they lost their numerical quality, becoming instead part of the Hip Hop lingo and jargon. This was most evident with references to weapons, drugs, and geography: use of numbers within language became a communication device that took on social aspects of inclusion/exclusion, that is, a way of speaking that transmitted adherence to the values of Hip Hop

culture. As such, the usage of numbers in the eight movies selected was antithetical to most educational notions regarding mathematics as a referential subject. While none of the movies extensively engaged with mathematics as a pedagogical discipline, the implied values posited in all movies downplayed the usefulness of formal schooling and its potential positive outcomes (i.e., a “good job”) by emphasizing, and thereby glamorizing, movie narratives about lifestyles that implicitly, and sometimes explicitly such as in *Notorious*, trivialized academic schooling and particularly referential mathematics.

Instead, the movies often highlighted the real life struggles that the artists encountered with law enforcement, and the early deaths of several of the protagonists (both in the movies and in real-life) served narratively to reinforce these notions. An essential and consistent narrative message of all the movies analyzed was the idea that success and power are obtained after brutally merciless struggles during which one climbs to the top through a combination of raw talent, dedicated work-ethic, aggression when necessary but more often patience, and the indefinable quality known as “street smarts.” In other research studies, this has been referred to as the “boot strap” theory, and is a central component of Hip Hop-based pedagogy (Wilson, 2016).

Based upon the results and findings obtained during this study’s analysis phase, it was determined that all eight of the movies selected displayed a predominant value-system that rejected a “regular” life and its well defined, pre-established patterns (e.g., go to school and then get a job). In fact, each of the movies promoted a language of schooling narrative that promoted self-education gained outside of institutionalized education. In essence, all eight of the movies featured artists that were primarily auto-didactic in procuring the knowledge they needed to succeed in their chosen craft and career. As an illustration, in *Time is Illmatic* the story of Nasir Jones’s rise to fame was narratively centered around his self-education, and in particular the level of native creativity seen in him by his father who also served as his teacher, as well as his father’s support of a young Nasir’s decision to exchange formal schooling for self-education. In each of the eight narratives, this rejection of formal education was often portrayed visually as the protagonist being at a crossroads where they believe they must choose between gang activities including crime, or focusing upon a music career, since a “regular” life, and the schooling it entailed, was not seen as a worthwhile option (for various reasons, depending upon each movie’s plot).

Successful Hip Hop artists portrayed in these movies thus shared the common quality that they were good at being “businessmen,” and their success in the music business was mostly represented as an ability to out-strategize the competition both musically and professionally. Hence the idea presented in many of the movies analyzed was that “The Game” of obtaining success in Hip Hop music was worth competing at, but that it was not necessarily a game wherein you needed referential mathematics abilities beyond basic arithmetic, coupled with entrepreneurial logic and strategy, to win. Anything beyond that,

the movies narratively argued, somebody else can be paid to do it, as portrayed in the movie *Hustle & Flow* when Skinny Black speaks of being supported by his team of “number crunchers.” Aside from such sardonic or dismissive mentions, references to actual persons being capable at mathematics were almost non-existent (except for the referential relationships discussed earlier), and most references to numbers as numbers *per se* (i.e., referential not symbolic) were generally static or durational time references, such as references to deadlines or meeting periods.

As each of the individual main protagonists of these eight movies demonstrated, Hip Hop themed movies often emphasize the battle between the temptation of a gang (i.e., criminal) life versus an artistic (i.e., musical) life, since for various personal reasons each of the protagonists has rejected, or feels they do not have the option, of a “regular” career. All eight movies thus embody the trope of rebellion against, and/or outright rejection of, the so-called “system” (i.e., the “schools-to-jobs” pipeline). Thus contemporary Hip Hop music and culture can be understood in the same vein as rock-n-roll during the second-half of the 20th century, during which counter-culture figures including Bob Dylan and Jimi Hendrix advocated for a new definition of the American archetype of the “self-made success story.” This is in keeping with the findings of Columbia University researcher Sam Seidel, whose line of inquiry has focused upon Hip Hop themed education, and consistently emphasized the importance of lessons having direct connections to the “real worlds and cultures” of students.

Before proceeding to a discussion of conclusions based upon this study’s findings, some research limitations should be noted. First, only eight movies were analyzed and these movies were all selected from the time period spanning 2001-2015; though consistent themes were found, other movies not analyzed during this study might display different findings. Second, the data analysis was filtered through the research-lens and life-experiences of the research team, and although we strove for objectivity it is conceivable that another research team would develop differing emergent subthemes, or vary in their specific coding of individual numerical references in the data, and therefore integrity of replicability is a concern. Despite these research design limitations, several noteworthy findings were determined from the data analysis, and will serve as the topic of the remainder of this paper.

Conclusions

As demonstrated by historical music genres as diverse as punk-rock and folk-rock, success within a musical career is not necessarily measured by “regular” definitions of aesthetic merit or cultural impact, but frequently serves to subvert those values and/or downright replace them. However, even within these incipient value systems, one consistent metric of musical success has consistently been achieving notoriety and mutual respect from peers and

members of that particular genre's musical community. This is in keeping with the recurring theme among all eight movies that success in a Hip Hop career meant overcoming economic, societal, personal, and psychological obstacles, and that success would only arrive as the result of patience, perseverance, and hard work—but when it did, the result would include the respect of one's musical peers.

Likewise, mutual respect between teachers and students has been recognized as essential to effective mathematics education. As early as the late 1970s it was determined by educational researchers that interpersonal perceptions and communicative relationships between teachers and students were crucial to the instructional process (Andersen, 1978). The degree of immediacy between teacher and students is an important variable in those relationships (Gorham, 1988). Joycelyn Wilson, a former high school math teacher, educational ethnographer, and scholar of Hip Hop pedagogy, found as part of the HipHop2020 Curriculum Project that relationship-reciprocity between teachers and students at the secondary and post-secondary level was a key ingredient in developing the social justice and leadership capacities of youth and those that influence them, particularly among African American young men (2011, 2013). Wilson refers to the utilization of this phenomenon in mathematics education as a form of Hip Hop-inspired Authentic Leadership Pedagogy (i.e., leadership that strives to embody the Hip Hop principal of: *Keep it real.*) that uses narratives, from movies and books and lyrics, as a medium for offering contemporary lessons about leadership, facilitating students' capacities for ethical character development, and providing ways for addressing the social justice needs of the community.

In further research, Wilson has linked the *language of schooling* to this investigation framework as a conceptual methodology, arguing that these interpersonal perceptions and communicative relationships are native and indigenous to linguistic and meta-linguistic practices—such as in the West African traditions of the *bard* and *naamu sayer* (2016). As an illustration, the role of Hip Hop within science education has been examined by Christopher Emdin, and he has determined that HipHopEd practice can start with activities that involve incorporating aspects of Hip Hop culture into the classroom, including the use of rap lyrics as text to be used in the classroom, and original raps created by students. Within this context, formats such as the rap battle have been used to create competitive situations that can promote rigor and advancement in academic growth. Emdin compares the use of Hip Hop in education to the promotion of innovative teaching methods, including his own brand labeled as Reality Pedagogy, which emphasizes the importance of teachers gaining an understanding of their students' individual realities and concerns in order to have a well-informed starting point from which to begin meaningful instruction (2016).

Emdin's Reality Pedagogy, and the other related teaching theories and methods discussed, provide a roadmap for further developing this type of

approach towards establishing an engaging math classroom, with the objective of providing teachers with the skills necessary to engross their students respectfully and authentically. Emdin argues that practices such as the well-informed use of Hip Hop music and culture within education will allow educators to achieve what he has termed the Seven C's essential to high-quality Reality Pedagogy. These Cs, practical tools that an educator can use in the classroom, are: (1) Cogenerative dialogues: wherein teachers and students discuss the classroom and both suggest ways to improve it; (2) Coteaching: wherein students get opportunities to learn content and then teach the class; (3) Cosmopolitanism: wherein students have a role in how the class operates and in what is taught; (4) Context: wherein the neighborhood and community of the school is seen as part of the classroom; (5) Content: wherein the teacher has to acknowledge their own limitations regarding content knowledge, and actively work to build content expertise along with the students; and (6) Competition: creating opportunities for youth to showcase and enhance their content knowledge via culturally-rooted competition amongst each other. The seventh C, created in collaboration with J. Wilson, is Curation and includes the creation and collection of artifacts from the enactment of the other C's used as part of the teacher's "cultural toolkit" (Swidler, 1986).

Incorporating the seven C's, programs such as Sam Seidel's *Hip Hop Genius: Remixing High School Education* have helped to engage students that felt their academic career was not in tune with the cultural values they legitimately identified with. Another example of this pedagogical practice is the "Funkamentalz" curriculum developed by Ranson Kennedy and Wade Colwell, which employs rap music to teach mathematical content such as the multiplication table (https://www.youtube.com/watch?v=k6od_fkszZI). This mathematics-themed song as well as others are a part of an album entitled "Education by Any Means Necessary" that strives to interject Hip Hop into modern math and science education, for all the reasons discussed earlier. As another example, a former rapper turned educator named Alex Kajitani, aka "Duey the Rappin' Mathematician," has found a niche using his Hip Hop skills as a context for teaching eighth grade algebra in Escondido, California, which is one of the most poverty stricken areas amongst all of the U.S.A.'s West coast. Likewise, "Mr. G & The Kiddie Crunk Crew" have created a collection of songs, videos, and games that provide students with new ways of learning using Hip Hop culture as a context. Another group termed DobleFlo, composed of Manny Dominguez and Luis Lopez, are a rap duo that uses math in producing hip-hop music, and have set up a music-related algebra challenge during which students calculate the tempo (i.e., beats per minute) of an instrumental sample, so they can adjust the tempo of an electronic drum track to match it. "Flocabulary" is another online service that has created mathematics education videos with a Hip Hop theme, along with interactive activities and online assessments for students in grades K-12. According to the company's website,

over 35,000 schools use “Flocabulary” to engage their students and increase achievement across the curriculum.

As discussed earlier, teacher immediacy is a theory that has attempted to break down the barriers between educators and students in the classroom by developing and encouraging behavior that reflects a more progressive, respectful, and equitable relationship between teachers and students (Andersen, 1978). Research that has dealt with experiences of immediacy often attempt to find factors in teacher student relationships that can help to accomplish this difficult feat of decreasing psychological distance, and numerous strategies for achieving immediacy between students and teachers have been examined empirically. Based upon this previous line of research inquiry, a recognized component in many of the successful efforts aimed at decreasing psychological distances between teachers and their students has been having the teachers learn about their students’ interests and culture, and then incorporating those themes into the lessons taught (Gorham & Zakahi, 1990). Some studies have examined camaraderie and mutual respect as a tool for achieving immediacy in the classroom, via educators taking the role of a facilitator instead of a guide or judge (Sibii, 2010), and based upon the findings from the current study it is the contention of this article that the utilization of Hip Hop music and culture fits elegantly within this framework, and shows remarkable pedagogical potential.

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