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American Institution of Public, K-12 Education: An Institutional Field Under a Complexity Paradigm

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by

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Abstract

Institutional fields serve as foundational bedrocks that shape and govern behaviors, norms, and practices within distinct domains of societal and organizational interactions. The emergence of machine learning and the ability to manipulate large datasets offer researchers and decision makers the potential ability to model and visualize the behavior associated with institutional fields.

This proof of concept provides an example of visualizing the changing conditions in the institutional field of public K-12 education in America as a topology. By interweaving three primary strands of theory – institutional fields, complexity in the guise of complex adaptive systems as a paradigm, and paradigms as logical systems, this research develops a novel methodology utilizing digital machine learning tools to generate a visualization of the institutional field.

The significant contribution of this study to institutional theory is the establishment of a proof of concept that institutional fields can be rigorously defined, measured, and modeled to yield valuable insights for policy and decision-makers. To demonstrate this proof of concept, the research introduces an Adaptive Institutional Topology Theory (AITT) as a guiding framework. This novel approach combines topic modeling and sentiment analysis with a newly developed Narrative Value-Based Coding (NVBC) technique, specifically designed to augment these digital methods.

Leveraging this model, it becomes possible to identify short-term trajectories for the institutional field, highlighting the roles of theory, definition, and visualization. Policymakers, organizational strategists, and researchers will find this methodology valuable in understanding institutional behavior, anticipating changes, and formulating

effective strategies within the field. Importantly, the methodology presented is scale-independent, making it applicable across various scales of social organization.

Dedication

I dedicate this work to my husband, Bruce. This is another chapter of our love story.

I dedicate this work to my children, Grace, Casey, Emily. My pride and joys. May your dreams be your guide.

I dedicate this work to Mom, Kathijean Keane and Nanny, Jean Keane. Your presence in the blowing wind and the shooting stars. Your eternal love is here with me always. Thank you for answering my calls.

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- My husband Bruce, you made me believe big ideas are possible. What a gift.

  My children, Grace, Casey, and Emily, how am I so fortunate as to have such supportive and wonderful children? I couldn't have asked for more.

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Preface

I became an educator, as many do, because I have seen how education can transform someone's life, contribute to the advancement of society, and generate connected, alive, and healthy communities. Like most new educators, I had big dreams of what my career as an educator would hold - for myself, my students, their families, our communities. I was extremely fortunate to land in a small, relatively unknown program tucked behind "the blue doors" called Cedar Lodge. My 12 years in Cedar Lodge showed me what was possible in education, in building community, in holding a sense of belonging, and in clearing a path for our youth to realize their highest hopes and see themselves as leaders - not necessarily leaders with a capital L, but leaders because they contribute to a world to which they are connected, and to which they affect.

My career path took a turn, not out of education, but out of the idealized space of Cedar Lodge when in 2012, Cedar Lodge was 'closed'. To the best of my ability, I cannot reconcile how any use of logic could remove this precious resource from the ecosystem of education - but it happened. Essentially, Cedar Lodge was crowded out. Our unique niche, although about as authentically and deeply an 'educational environment' as one could imagine, didn't fit the landscape. Why? What changed that created a 'state flip'? Rigidity was encroaching, that was clear. For our little oddball program, Cedar Lodge was our world. It is where students were assessed as individuals - nongraded, yet rigorously assessed through goal setting, self-evaluation, peer evaluation, all based on the individual doing their personal best. Independent learning thrived; they became 'experts' in two topics a year and shared their knowledge and expertise with the rest of us. They read books, guided by volunteers (parents, grandparents, community members) who came weekly to

read and commune around books that middle schoolers chose. In these literature circles, they discussed topics middle schoolers care about, and shared a love for literature and our collective imagination, and they often enjoyed a snack one of the volunteers would lovingly share.

Some of their most highly prized time in the day was our end of day read aloud. Cedar Lodge allowed space to explore the connection between and among typically siloed subjects (math, reading, science, social science, art, music...). Cedar Lodge was unique; Cedar Lodge members were unique. The costume box was used often and for good reason. Students and teachers ate lunch together, sang together, shared the public sidewalks together (well, mostly) when we explored our world through 32 or so field trips per year. Students and teachers had fun learning.

I say this, because for each of my long list of joys (and I could go on), I found quite the opposite when Cedar Lodge closed and I moved to the other side of our school building. Daily, I would try to implement the same strategies, priorities, pedagogy - but there were so many new constraints that it made a job that is already difficult, nearly impossible. I had 42 students in my classes. I remember feeling desperate about finding enough chairs and embarrassed when our weekly visiting student from the life skills program had to have tables moved so they could get their wheelchair past the classroom door. The kids were just as amazing no matter what part of the building I called homeroom, but the ecology of this learning space was different, not just in degree, but in kind. I was feeling diversity squeezed out of the system; the goals of learning changed from what I described above to names and numbers on a spreadsheet and squeezing out the most efficient way to improve

the metrics. My teaching goals were mandated to reflect this cold, disorienting objective to churn out high test scores, and demands were placed on how we spent our time together 'learning'.

The costume box was donated to Goodwill. Field trips became *a* field trip held at the end of the year for all 200 students in the grade where students would descend upon a large space such as the zoo and just cross our fingers that all of us survived the day. Everything changed. And, it wasn't just me. It was all around. The narrative had changed and words like 'fidelity', 'rigor', 'accountability' took on a life of their own. They became trigger words for many of us who were watching, in real time, the vitality of learning escape the classroom. As I move into explaining this 'problem space', I want to be clear that I am speaking about my own lived experience. I know that there are educators out there doing amazing things - keeping that love of learning alive. For me, the journey took a new path. I wanted to understand what was happening to our education system as a whole. This research is the product of that journey.

In 2001, newly inaugurated President Bush wasted little time to shine a light on what he described as "the cornerstone of my Administration", realized as No Child Left Behind (NCLB Act), education reform that sought to deal with the concern that "too many of our neediest children are being left behind". Twenty years later, the legacy of what were the cornerstones of his plan, especially the effort to measure educational attainment as educational units retrieved on demand through standardized testing regimes and rewarding or punishing schools based on their ability to install those units in the heads of their students along with a retrieval mechanism for use at test time, seems almost trite. It is now

common knowledge that tests are biased; learning styles are a spectrum; and standardized tests mostly measure the ability of a student to do well on standardized tests. Not that there aren't good reasons to conduct standardized testing in a district setting, but what the results are able to tell us may not be a good metric for the success or lack of success of a particular school or population and especially a particular student.

I turned to academia to help me understand what happened. How did this federal legislation have such a direct and profound impact in my classroom? Given that public education is a responsibility of the state and my school district is its own decision-making body, how is it that this federal reform became implemented, monitored, and systemically embedded in my school district, in the school districts in my state and ultimately within all 14,229 school districts across our nation at that time.

Theory, it was my hope, would help me understand what was happening. I believe the job of theory is to suggest consequences of actions. Those equipped with theory have a tool to help guide decisions. But what theory could account for the idea that the quality of education is measurable in standardized units and that this approach would produce equity across the entire landscape?

What I came to notice is that the authors of that legislation were treating this delicate, complex dynamic system (the institutional field of education) as if it were a machine - trying to engineer it to produce the desired outputs by "tweaking", fixing, replacing the parts they decided were broken.

This is a common response to 'wicked problems'. Yet research shows that, when grappling with wicked problems, there are multiple and competing ways to define "the

problem". Therefore, one solution designed to engineer our way out of a wicked problem is a futile, and damaging effort. Wicked problems reside in the realm of complexity, and they are so intertwined at a confluence of so many influences that trying to solve just one of the problems (one strand of its wickedness) often creates problems for another group within the same problem space.

So, why would lawmakers try to engineer a whole institution, one that spans across the many divides of society? I had a hard time believing that lawmakers' intention was to try to engineer their way out of a wicked problem, especially since the institution of public K-12 education is often offered as a classic example of a wicked problem.

To navigate the system, I had to understand how the system was set up. I had to understand its theory. I had to understand what was being operationalized at its foundation and what consequences might follow from that theory. I had to know how leaders could avoid such decisions going forward.

To try to understand how to serve my students the best way possible under the new regime, I needed to understand the methods and theoretical frameworks that informed the framers. What were the assumptions that led the authors of that legislation to choose that structural configuration? What logic suggested to those authors that this bill would produce the desired outcomes? Eventually I ended up in a doctoral program at Portland State University studying institutions, organizations, and institutional fields.

My research involves institutional fields. In 1983, Paul DiMaggio and Walter Powell published a paper titled "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields" which introduced me to a way of

understanding how change might sweep across an entire sector - a whole field - seemingly all at once. To me, it was the doorway to what has become known as the study of complex adaptive systems. And it directly led to my work developing adaptive institutional topology theory as a general theory of social institutions modeled and understood as a dynamic landscape.

In the course of my studies, I discovered that there is a paradigmatic difference between a vision of society as a vast machine and of society as an ever-adapting landscape exhibiting the qualities of what has come to be called complexity. The qualities of complex, adaptive landscapes/systems include emergence of novel forms, feedback, and the concept often called 'holism' which acknowledges that the properties of the whole are not deducible by knowing the sum of its parts. This last concept is what is meant by emergence. And, because complex adaptive systems are exactly that - "complex" and "ever changing", they have proved challenging for social scientists to measure, model, or visualize as such.

With the technological advancement of machine learning tools that can capture patterns within large datasets, it is now possible to model and visualize complex adaptive systems. This study applies the tools and concepts within complexity science to the empirical space of social science. "An institutional field under a complexity paradigm", the subtitle of this research, places the institutional field under the paradigm of complexity using the example of American public K-12 education, and brings new insights to how we understand and explore this empirical space.

Introduction

Visualizing the institutional field of public K-12 education in America.

Weaving together three strands of theory - institutional fields, complexity in the form of complex adaptive systems as a paradigm, and paradigms as systems of logic - this research develops methodology using new digital machine learning tools to visualize changing conditions in the institutional field of public K-12 education in America at a national scale. The main contribution of this work to institutional theory is a proof of concept that institutional fields can be both rigorously defined as well as measured and modeled to provide useful information for policy and decision makers.

The methodology developed in this research is scale independent. It could be applied to any scale of social organization. But that will not be tested in this research. Having a methodology that applies to any scale of the organization is of particular importance for future research because institutional fields are multi-scale, multi-level, and produce significant feedback between levels. By utilizing available digital visualization tools, it should be possible in future research to identify feedback between multiple levels as well as measure the transmission and spread of information across the institutional field over time.

Of particular note is the timeliness of this research. New machine learning tools with the ability to process extremely large datasets are now available although still in their relative infancy. Our existing theories were born in an environment where data was limited and often difficult to attain. As P.W Anderson (1972) describes, more is not just more. More is different. New tools greatly enhance the ability to see interactive change over time.

This research is an attempt to provide a way of thinking about social organization that allows us to see dynamically in motion rather than as static snapshots with arrows leading from one to the next, as well as a methodology for incorporating new tools in service of a vision that can take advantage of their potential.

This research argues that institutional fields must be placed into a paradigmatic structure to generate consistency across modeling techniques and that social fields must be modeled as a landscape in order to realize the benefits of that consistency. For that reason, this research begins with the theoretical background necessary to situate institutional fields within a complexity paradigm. That theoretical background will offer not just guidance to the methodology but should also be able to evolve as a program of research, as methodology, under this paradigm as it is refined.

Problem Statement

In order to model complex adaptive systems, methods are needed that are capable of capturing the paradigmatic axioms of complexity. With the introduction of big data and machine learning techniques based in natural language processing, researchers now have tools capable of modeling an institutional field as a complex adaptive system. But a methodology to guide and frame an approach to this type of research has not been applied to institutional fields.

This research focuses on three of the most intractable types of problems found within institutional theory. In the literature, and exposed in practice, three problems alert interested parties to the need toward transformational solutions: wicked problems (Rittel and Weber, 1973), counterintuitive behavior of social systems (Forrester, 1971), and managing for outputs (Holling, 1973). These problems have been difficult to manage,

measure, and model.

The primary differences between the traditional and complexity paradigms are how each treats the notion of causality. The traditional paradigmatic model of the institutional field of public K-12 education in America is based on *managing for outputs* in a complex, multi-jurisdictional, networked environment. The traditional paradigm treats wicked problems as an endless game of whack-a-mole, solving each problem as it arises even when the solutions are themselves largely the problems that arise to be solved next. The complexity paradigm of the institutional field, developed in this research, is based on *managing for conditions* in an open, dynamic system. Managing for conditions focuses attention on systemic issues of sustainability, resilience, and reorientation (or collapse) rather than the narrower instrumental means-ends issues of performance outcomes and managing for *sustained maximum yields* (Holling, 1973).

This research places these problems within the context of the complexity paradigm where they can be understood differently, leading to new approaches to measuring them, modeling them, and of visualizing them. Ultimately, this approach offers leadership new tools to understand and manage these types of problems.

Goal of this research

This research develops a useful open systems theory of the institutional field using American public K-12 education as the example. I name this theory "adaptive institutional topology theory" because it can be formulated in a general form where social organization takes place within institutional contexts by framing the institution as an adaptive system and the structural view as a topology. This research provides a proof of concept that institutional fields can be visualized based on the techniques developed utilizing that

theory. Adaptive institutional topology theory situates institutional fields within the domain of complex adaptive systems and includes mechanisms to capture and measure critical elements of institutional fields in ways that submit to modeling and visualization for analysis.

The goal of this research is to offer leaders a framework, tools, and meaningful ways of approaching institutional fields as complex adaptive systems. The case study is used to explore the relationship between managing for outputs and managing for sustainability and resilience in a complex, multijurisdictional, networked environment, such that resilience and reorientation (or collapse) become the larger context within which the conditions for persistence and stability are visible.

Research Agenda and Structure

The models pursued in this research elaborate and extend features of the new institutionalist concept of institutional fields and the complex adaptive systems (CAS) model by applying aspects of systems and complexity theories using the language of signals and boundaries. This research offers a new theory named adaptive institutional topology theory and, in turn, a methodology applied to the logics associated with institutions through institutional fields.

Part One

Part One addresses the paradigmatic nature of this methodological approach, beginning with a clearly stated theoretical grounding of the complexity paradigm as it relates to institutional fields. Two contrasting paradigms are described complete with fundamental assumptions, grounding principles, and a framework from which the objects of inquiry are defined, understood, and operationalized. Adaptive institutional topology

theory is offered as a way to operationalize the institutional field by identifying fundamental elements of the field understood in terms of a topology and framed as a complex adaptive system.

Parts Two and Three

Part Two and Three deal with the methods and the measurement of the empirical space as it is constructed from the axioms presented in Part One. The empirical space of American public, K-12 education, and specifically, the institutional field of public K-12 education in the United States are centered in this study. This section explores the case study using methods drawn from complexity science and machine learning.

Parts Four and Five

Parts Four and Five focus on the practical implications of using adaptive institutional topology theory and related methods. The implications of using tools and assumptions within the paradigm of complexity versus using tools and assumptions within the traditional paradigm of linearity are outlined. Lessons for leadership are presented so that the complexity paradigm carries beyond this research as not only theory and method, but also a practice. The complexity paradigm shifts the way in which leaders frame a problem. It requires a change in the way in which outcomes are defined and redirects our attention from outcome to process. This section ends with a list of suggestions for further study using the theory and methods applied herein.

The research sections are cumulative. That is, each section cumulatively informs the next, each contributing to the overall theory and its application. Part One offers a new way of understanding, one that challenges the completeness of the traditional paradigm. The case study that follows in Part Two and Three provide examples of how the proposed

paradigm can reframe empirical reality to incorporate the anomalies that challenge the traditional paradigm. "[A]t times of revolution, when the normal-scientific tradition changes, the scientist's perception of his environment must be re-educated" (Kuhn, 1996, p. 112). The case study illustrates what is meant by paradigm shift or revolution.

Part Four and Five provide a guide for normal science under a complexity paradigm, a new scientific approach to the study of institutional fields using the example of the institutional field of K-12 public education in America as a case study. Part Two and Three, therefore, help to visualize research under the complexity paradigm for the social scientist. Part Four applies this research to lessons for leadership and Part Five offers novel applications for the theory and methods used in this research.

Empirical Space - The institutional field of public K-12 education in America during NCLB era reform

The empirical space of this study is the period leading up to and following the reauthorization of the Elementary and Secondary Education Act (2001) known as No Child Left Behind, the time period of January 8, 1993, to December 31, 2004. This was a period of education reform in which the majority of the states were willing to offer the federal government a more central role in directing public education, a constitutional right reserved to the state under the 10th Amendment.

In most cases, American public K-12 education service delivery is accomplished through small jurisdictional arrangements - special districts - where professional bureaucratic structures function to meet the societal goals of educating our youth. But these special districts are more than instrumental bureaucratic structures. From a macro level, our education systems are institutions (DiMaggio and Powell, 1983) composed of

cognitive, normative and regulative structures and activities (Scott, 1995). The institutional perspective draws our focus outward to the network of systems in the larger community of which schools are a part. Understanding an institutional field as a series of overlapping systems subject to multi-scale dynamics places institutional fields squarely in the landscape of complex, dynamic systems.

This research draws from a variety of institutional and organizational scholarship to identify the minimum structural considerations sufficient to reveal systemic patterns of behavior within a public K-12 institutional field setting. These patterns have been identified by Scott (1995) as consisting of "cognitive, normative, and regulative structures and activities that provide stability and meaning to social behavior. Institutions are transported by various carriers – cultures, structures, and routines – and they operate at multiple levels of jurisdiction" (p.33). To identify examples of those behaviors in action, this research draws on the work of Phillips, Lawrence, & Hardy (2004) who suggest that written documents are the main transporters of those cultures, structures, and routines, and that those written documents identify institutional changes as active parts of the process. Extending Phillips et al. (2004), this research proposes that those written documents can be further distilled into value statements and topics representing signals processed by the field and that those topics and value statements represent a structural aspect of the institutional field which submits to modeling.

The corpus is intended to capture the broader narrative, public discourse of public education during this period by using widely distributed newspaper publications. The five newspapers included in this study are the *New York Tim*es, *Wall Street Journal*,

Washington Post, *Los Angeles Tim*es, and the *Chicago Tribune*. Filtering the articles for final selection was done within the ProQuest database and search terms included "education reform", "public education", "public school", "k-12", "NOT obituary".

The institutional field has been widely accepted as important in a variety of applications but there is currently no general theory that adapts to any situation where the field level of analysis is central (Zietsma, C., Groenewegen, P., Logue, D. M., & Hinings, C. R., 2017). Elaborated upon later, but germane to the development of this research, I offer the following definition of an institutional field, 'a landscape upon which a category of values competes for legitimacy'.

This research includes a number of other definitions of the institutional field, however none define it as a landscape. I, however, do. And, I believe the institutional field must be defined as a landscape in order to provide a generalizable utility.

Part One: Theoretical Background

This research requires an understanding of what it means to say that public education is an institution and to that end adopts the following assumptions. First, institutions are socially constructed (Berger and Luckmann, 1967). That is, institutions are an emergent property of socially constructed reality. Berger and Luckmann (1967) describe institutions as the product of patterns of social behavior that become embedded in social structures and thereby support enduring social norms of what is acceptable and what is not by those living within the social setting. Scott (1995) echoes this sentiment with the assertion that the "cognitive, normative, and regulatory structures" of which institutions consist in turn provide a feedback effect that "provide stability and meaning to social behavior" (p.54), which presumably leads to an intensification of those cognitive, normative, and regulatory structures.

A second core characteristic of institutions is the moral weight that is attached to these entities by those who are impacted. Education clearly falls into Selznick's (1992) description of a moral institution. Our public education system has moral meaning for those who are served as well as for those who work to make this institution successful. Because institutions hold values, they are inherently filled with tensions. On the one hand they are open to change by outside forces while at the same time holding on to values that resist such change.

The tension explored in my research highlights NCLB as a product of this historical process of institution building. Over time our current educational organizations have adapted to both internally generated dynamics as well as external pressures and influences.

Internally and over time, our schools have shifted from focusing on instrumental organizational goals to the larger functional purposes that education serves the broader society. This shift away from viewing schools as organizations to viewing schools as institutions also involves a shift in priority and language. The frame of reference is shifted away from goals to values, the beliefs that develop internally about those purposes, and to the larger moral purposes education serves in society. By reframing the initial, functional, purpose driven objectives as values, distinct ways of thinking and deciding evolve within the institution itself (Selznick, 1992). Externally, the community views the institution as "a locus of value and a center of power" (Selznick, 1992, 237). As Selznick (1992) explains,

> [t]he surrounding community has a stake in its existence and in the proper conduct of its affairs. There is pressure from without to make the organization an integral part of the larger community, and to do so in part by recognizing its claims to moral autonomy. For an open system with permeable boundaries, no transaction with the environment is more important than negotiating its place in the moral order, that is, dealing with demands that it be responsible and responsive (p.237).

An important element of "thinking institutionally" is the difficulty of separating the parts from the whole, separating causes from effects. Peter Senge (2006) illustrates this point with a Sufi proverb about understanding an elephant. We must know the whole elephant since "dividing the elephant in half does not produce two small elephants" (p.66). The object under investigation, the institutional field of education, will be considered an ontological and systemic whole - something more than the sum of its parts. Emile Durkheim (1938) announced in his *Rules of Sociological Methods*, "[t]he first and most fundamental rule is: Consider social facts as *things*" (p.14, emphasis original). But it is

important to remember that, even when reified as things, social facts change over time. The system state evolves.

Institutions as Things

Institutions are not as easily identifiable to the human senses as things with a stable persistence like a brick. Rather, aside from the outward symbols of their existence - signs, buildings, logos, products and the like - one must identify them as patterns in time, as eddies within a larger flow of society. This comes as no sort of revelation to institutional scholars. Nearly a century back, Durkheim suggested that institutions may be noticed by their effect, "recognized by the power of external coercion which [they exercise] or [are] capable of exercising over individuals" (Durkheim, 1938, p.10). And social facts are objects that are collectively held. They exist beyond individual experience. As objects, institutions seem fairly permanent. They exist before individuals may be aware of their existence (owning a historical quality) and can be presumed to carry on after our own existence (Durkheim, 1938). Or, as Berger and Luckmann (1967) put it, "An institutional world, then, is experienced as an objective reality. It has a history that antedates the individual's birth and is not available to his biological recollection. It was there before he was born, and it will be there after his death" (p.60).

Talcott Parsons (1934/1990) defined the structure of the institution as derived from the norms defining the relations between individuals that the institution is tasked with regulating. In this sense, institutions are form-giving, "they constitute a 'form,' a 'mold' into which these individual acts fit" (Parsons, 1934/1990, 327). While it seems that Parsons presents a dynamic portrait of a social system, C. Wright Mills (1959) raises a critical concern regarding the quality of Parsons' theory, a concern that is also central to

understanding a dynamic systems perspective of institutional life. According to Mills (1959), Parsons' theory lacks the clarity of practical reality. For Mills (1959), a grand theory is only useful if practitioners can logically get down to observation (33). Translating Mills' concern into systems language, Parsons constructs a closed system, one that is limited to its own starting conditions and absent of unique, situational environmental feedback. He constructs the institution out of a means-end process resulting in an "ultimate end" ignoring the feedback that local conditions with unique character may produce and the effect of that feedback on the "ultimate end". Mills notices this omission, and while Mills does not label it as such, he does elaborate on the critical interaction between situational conditions (labeled "problems") and larger societal concerns (labeled "issues").

John Dewey (1938) identified a similar distinction when he wrote, "The connection of social inquiry […] with practice is intrinsic, not external. Any problem of scientific inquiry that does not grow out of actual (or "practical") social conditions is factitious; it is arbitrarily set by the inquirer instead of being objectively produced and controlled" (Dewey, 1938: 499, Quoted in Selznick, 1996, 270).

Mills (1959) coined this cyclical interaction the key feature of "the sociological imagination", a space where we can capture/imagine the dynamic interaction of person to society and society to person. When we use this sociological imagination,

> [we k]now that many personal troubles cannot be solved merely as troubles, but must be understood in terms of public issues - and in terms of the problems of history-making. Know that the human meaning of public issues must be revealed by relating them to personal troubles - and to the problems of the individual life. Know that the problems of social science, when adequately formulated, must include both troubles and issues, both biography and history, and the range of their intricate relations. Within that range the life of the individual and the making of societies occur; and within that range the sociological imagination has its chance to

make a difference in the quality of human life in our time. (p.226)

The whole of the institution, the thing, is dynamic and evolving but persistent. It is also multidimensional, operating through a variety of independent forces, and operates at multiple, hierarchical scales. W. Richard Scott (1995, see Table 3.3, p. 57) outlines the varying levels of organization and at each scale identifies the theories associated with each of his institutional pillars, those vital components of institutions or facets "contributing in interdependent and mutually reinforcing ways, to a powerful social framework - one that encapsulates the celebrated strength and resilience of these structures" (Scott, 1995, 34).

Society plays a significant role in designing, shaping, and directing the actions of the institution. After all, institutions are a product of human intention and an emergent quality of socially constructed reality. This research argues that the dynamic interaction between the collective intention of the organization, the moral obligations of the humans of which the organization is composed, and the needs, problems, and issues of stakeholders to whom varying moral obligations are expected, when viewed through the lens of values, offers a nuanced potential for understanding when run through the logic of a complexity paradigm.

Institutions and Values

Selznick's (1957) infusion of values "beyond the technical requirements of the task at hand" (p.17), refers to a gradual shift in valuation from the utility of addressing immediate tasks to a valuation of the organization as a thing in itself. But the dynamic interaction between those categories of values are significantly more integral to the evolution of institutions than simply the discovery that the social construct of the

institution is a thing in itself to be valued. Selznick (1992) elaborates on this point:

> When we view an organization 'as an institution,' we may mainly be concerned with the values it embodies, from the standpoint of the people whose lives it touches as well as that of the larger community. Insofar as it is 'infused with value,' the organization is likely to claim and be granted respect and concern. At the same time, to be an effective participant in the moral order, it must be competent, intentional, and accountable. (p.239)

Critical to this research design is the assumption that institutions are in many ways products of the values of which they are carriers. This research introduces the following propositions extending the notions of habit and stability as an approach to defining and understanding values as indicators of field behavior. Taken together, these propositions form a part of the justification for a device to structure empirical investigation of institutional dynamics as complex, dynamic systems by identifying values competing for institutionalization as the material forming the structure of institutions. These propositions comprise a fundamental element of the adaptive institutional field theory presented at the end of Part One.

Propositions

1. Values are often a stand-in for the idea of habit when the process does not submit to routinization. That is, when person A knows a value held by person B, person A has a general knowledge of how person B will act when presented with novel choices in a dynamic environment.

2. The primary application of value as used by an individual is to inform action. From this, we can identify and (potentially hierarchically) categorize specific and generalized values from actions, statements about actions, and from stated goals.

3. One of the primary applications of values within a group is predictability and stability. From this we can view institutions as carriers and conduits of value.

4. Values that enter institutions involve multiscale dynamics. The initial typology used in this research will account for the following three pathways for values to enter into the institution and begin to have an impact:

    a. Local. This refers to bottom-up processes of individual problems merging into social issues.

    b. Professional/Institutional. This avenue refers to horizontal processes and is loosely analogous to Scott's (1995) normative pillar as well as DiMaggio and Powell's (1983) normative mechanism.

    c. Political/Legislative. This avenue refers to top-down processes of imposed structure and is loosely analogous to Scott's (1995) regulative pillar and DiMaggio and Powell's (1983) coercive mechanism.

5. The competition between values at the societal level is a competition for legitimacy of favored values. The degree of legitimacy, or the number of people who accept a given value as legitimate, is inextricably tied to the systemic stability of an institution.

In summary

- Norms and rules and many structural aspects of institutions reflect underlying values. Shared legitimacy of those values largely determines the roles and habits individuals are willing to adopt in service of those values.

- Individuals within the institution largely allow their behavior to be guided by those values. This provides the stability that becomes institutionalized.

- The infusion process of values into the institution then is the foundational behavior of the process of institutionalization.

- If researchers can identify the integration process of values into the institution, they can then identify the values themselves, which in many ways define the institution.

- When those values are identified, collected, and analyzed over time, historical changes in the institutional field should be visible.

Institutional Fields

In this study, "institutional field" is the unit of analysis. New institutionalist scholars, DiMaggio and Powell (1983) first identified the institutional field as a unit of analysis due to the emergent property of isomorphism – which they considered a result of three mechanisms of operation: coercive, normative, and memetic. Most of the focus on their seminal work has been on the effect of these mechanisms: institutional isomorphism, the tendency of organizations across a field to become more similar over time. However, this research is not only concerned with the effect of the mechanisms of isomorphism on the field, but also on the understanding and study of the institutional field itself.

Definition: I define the institutional field as a landscape upon which a category of values competes for legitimacy. The structure of the field is comprised of those values that have been institutionalized or codified in law, policy, habit, myth, or ceremony. The category of values that define the field are those which inform behavior related to the institutional purpose. The behavior of the field can be viewed in two distinct ways; first as the response to signals that trigger the institutionalized values to generate action within the field, and second as the change in values within the field over time. The notion of agency required for a competition of values to occur is omitted intentionally. What matters are the values and the responses. This definition is drawn from the conceptual scheme John Holland (2012) developed in his book, *Signals and Boundaries*. The boundary of an institutional field is defined in this research as all individuals who possess values that serve to convert signal into action. This last point will be expanded in the section, Signals and Boundaries, where institutional values are framed as a kind of classifier system.

In the book *New Institutionalism in Education* (2006), the authors investigate the

institutional field in their discussion of isomorphism within K-12 education, although they grapple with clear definitions of the institutional field. For example, they do not clearly define the boundary of the K-12 educational field. Brian Rowan (2006), in the chapter "The School Improvement Industry," argues that when investigating theories of educational change in the U.S., the organizational set must include more than just schools and governing agencies, which he calls the school improvement "industry" (68).

In some regards, it is more convenient to define a field by analogies than it is to adhere to a single, shared definition. The concept of the organizational field is often associated with the concepts of industry, sector, population, and domain because they all define boundaries within which processes and patterns of interorganizational competition, influence, coordination and flows of innovation operate (DiMaggio, 1991, p.267). For example, Scott and Meyer (1991) define a societal sector as

> (1) a collection of organizations operating in the same domain, as identified by the similarity of their services, products, or functions, (2) together with those organizations that critically influence the performance of the focal organizations: for example, major suppliers and customers, owners and regulators, funding sources and competitors. The adjective societal emphasizes that organizational sectors in modern society are likely to stretch from local to national or even international actors. The boundaries of societal sectors are defined in functional, not geographical terms: sectors are comprised of units that are functionally interrelated even though they may be geographically remote. (p. 117-118)

According to Scott and Meyer (1991), the concept of sector is similar to the concepts of "industry system", "interorganizational network", and "organizational field" (120). The institutionalization and structuring of the organizational field, comprised of formal or informal networks of organizations "committed to supporting, policing, or setting policy toward the 'industry', must be understood before an organizational form can

be clearly understood (DiMaggio and Powell, 1983; DiMaggio, 1983; DiMaggio, 1991, p. 267). DiMaggio suggests that an institutional field is more than simply an aggregative construct of an institutional form. It is a product of institutional change. That is, the field changes in relation to other aspects of the institutional landscape.

Researchers often approach the institutional field as a taken-for-granted, non-directed, non-conflictual product (DiMaggio, 1991). But structures take form through dynamic, intentional, directive, and conflict laden interests - processes that are often silent in the new institutional theory (Brint and Karabel, 1991). The model and visualizations used in this research aim to illuminate the narrative that emerges from these dynamic, intentional, and conflict-laden forces shaping the field's genesis and existence, and in fact suggest that the model of those elements serves to define the high-level view of the field completely, allowing drilling down in areas of particular interest.

When one looks at the field from the perspective of an outside observer, a mature normal science utilizing the complexity paradigm should be able to reveal dynamic connections between the organizations operating together (Scott and Davis, 2007). Although the corpus chosen in this research cannot produce visualizations of those connections, a different corpus drawn from organizational levels should be able to do this. Corpus choice is a major issue directing what the researcher intends to visualize and especially what details of evolution the investigation is pursuing.

In this proof-of-concept model, the focus is on the fourth of Scott and Davis's (2007) four advantages associated with the field level of analysis, but each of them is amenable to the same logic. The four advantages are 1) the interdependence and

coevolution of a variety of organizations can be examined, 2) the waxing, waning, and evolution of organizational types can be seen over time, 3) the field level includes other levels, and 4) the organizational field provides a bridge, "an important intermediate unit, connecting the study of the individual organizational structure and performance with broader social structures and processes" (Scott and Davis, 2007, p. 119). From the observer's perspective, fields are dynamic entities. They interact, include multiple levels of subsystems, evolve, and offer the observer additional information about the dynamic landscape within which organizations operate.

The complex interactions in today's world make this last benefit of field level analysis more than simply an advantage. In today's highly dynamic and turbulent environment, it is unlikely one will encounter much in the way of closed systems or easily identifiable boundaries (see Davis and Marquis, 2005). Davis and Marquis (2005) go so far as to suggest, "[b]y some accounts, the imposing objects of organizational theory have evaporated" (332). Therefore, as humans attempt to navigate the turbulent and blurred boundaries between organizations, the field level analysis is a more practical and appropriate approach than working to locate the organization's unit of analysis (Davis and Marquis, 2005).

Since fields emerge from the behavior of their subsystems, a field can be studied by looking at its internal dynamics or from the perspective of a participant. One can study the interrelations between institutions, organizations, and individual actors through the institutional field-level logics perspective. This perspective situates actors in a social context, a highly regarded advantage of this approach (Thornton, Ocasio, & Lounsbury,

2012).

Field level processes shape micro and meso processes, and vice versa (Thornton et al., 2012). From a systems perspective, fields offer a holistic account of the processes that shape and are shaped by individual elements of the system. Observing the system and its subsystems in operation redirect attention from the output of the system to the system itself. Wooten and Hoffman (2008) highlight the need for this 'refocusing' within the future organizational field research,

> [t]o move away from the current focus on field outcomes and towards an understanding of why field-level interactions remain vital to organizations, fields must be seen, not as containers for the community of organizations, but instead as *relations spaces* that provide an organization with the opportunity to involve itself with other actors. (p. 138, emphasis original)

System dynamics also demand that attention is paid to all levels of system health and operation. This addresses another of Wooten and Hoffman's (2008) demands for future organizational field studies that it will focus on the process of participating in a field and what this participation ultimately means for the inner workings of the organization (Hoffman, 2001). To date, field research has largely provided an explanation of macro to macro transitions; field-level interactions lead to changes in structure, culture, and output at the aggregate field levels (p. 141).

The research methodology used in this study, based on a discursive model of institutionalization (Phillips, et al., 2004) is designed to capture the micro-level behaviors of the system as well as the macro-level aggregation of those behaviors.

Fields are often presented as a useful level of analysis. However, there is no general "theory of fields" (Davis and Marquis, (2005). There are few standard definitions, field

level characteristics, or attributes, and this ambiguity makes it difficult to generalize about the endogenous elements of fields. It is easier to place fields as objects within the environment and study how that object changes due to known pressures –either endogenous or exogenous to the field. This is a reductionist approach by its nature. Just as humans do when they encounter a new/foreign object in nature, they run experiments on the object to better understand it and to see what causes a response.

While researchers often include the field as an independent variable (Scott, 2001), using the field as a dependent variable requires a level of understanding about the endogenous factors within the field. To do this work, one must first locate aspects of the field that hold shared meaning and significance. Finding specific field-level characteristics, definition, and attributes has proven to be challenging. Scott (2001) summarizes four field level topics investigators often use for clarification when studying fields: boundaries, logics, governance, and structuration (see Scott, 2001, Ch. 6).

The generally agreed upon features of institutional fields quite clearly fit within the assumptions of open, nonlinear systems. Fields are dynamic. They emerge from the interactions and behavior of its subsystems. They include multiscale dynamics. The question becomes not what fields *are* (linear, closed systems or open, nonlinear systems), but how one *understands* them.

This research draws primarily on the works of Ashby (1970), (Bertalanffy (1950), Forrester (1971, 1975), Checkland (1999), Meadows and Wright (2008), Senge (2006), Laszlo (1973), and Lane (1999, 2000, 2001a, 2001b), regarding systems modeling requirements; and Snowden (2002, 2015), Holland (2006, 2012), Wheatley (2006), King

(2000), Meek (2010), Morcol (2012), Morgan, Ingle, and Shinn (2019), and Sallach (2000) for paradigmatic insight on coping with complexity and nonlinearity; and Luhmann (1995) and Mingers (2002) to help situate the requirements of a social theory into the model of complex, dynamic systems.

An open systems viewpoint of organizations and institutions operating within environments in and of itself is generally uncontroversial in institutional literature (Morgan, 2006; Scott and Davis, 2007; Selznick, 1992, 1996; Shinn, 1996). The two-way role of values and goals in generating institutional structure is also uncontroversial, at least as a generalized concept (Berger and Luckmann, 1967; Giddens, 1984; Parsons, 1990; Selznick, 1992; Morgan, Ingle and Shinn, 2019).

The essentially functionalist idea of using systemically-oriented schematics to model the operations of society and institutions also has deep roots. From early theoretical pioneers defining a formal structural-functionalism Grand Theory, exemplified in the bodies of work by Durkheim, Parsons, and Merton, to much more concrete applications providing command and control based in cybernetics (Ashby, 1970), and, capitalizing on the advent of computers able to solve certain classes of differential equations to discover counterintuitive feedback resulting from policy choices (Forrester, 1971, 1975), the recognition that socially constructed realities exhibit pattern and structure has inspired a broad range of thinking about the rules governing those patterns and structure.

This research suggests that fields are being used by researchers and academics as "things", as tools that produce outcomes. Regardless of the extent to which fields *are themselves* nonlinear, open systems, humans interact with them as "variables" or "things

that produce outcomes" (Wooten and Hoffman, 2008, in Sage, p.137; Emirbayer, 1997). As Mustafa Emirbayer (1997) claims in his *Manifesto for a Relational Sociology*, "The key question confronting sociologists in the present day is not 'material versus ideal', 'structure versus agency', 'individual versus society', or any of the other dualisms so often noted; rather, it is the choice between substantialism and relationalism" (282). However, applying current tools to the study of field processes is challenging, if not impossible. Studying the process of objects whose identifying feature will not "hold still" long enough to agree upon their characteristics, definitions, and attributes makes the application of a mechanistic social science paradigm nearly impossible.

Operating within the traditional paradigm, we look to identify the "thing" first. Humans look for its permanence, causal mechanisms, and its utility in production – as an output or a tool. They seek to understand it so they can either manipulate it or devise strategy to take advantage of its behavior. This is essentially a cybernetics approach to systems - searching for the levers which allow control of the system.

It is becoming apparent that there are problems with the cybernetic or engineering-based approach to understanding. "Concepts such as organizational field challenge and supersede earlier concepts, such as environment, which favor a passive construction" (Scott, 2001, p. 136). In a dynamic object with exceedingly fuzzy boundaries, there is very little that can be held still long enough to manipulate it. One sees the pattern in time, a pattern that is generated from the operation of the system.

This is reminiscent of the eddy in the river. In order for the eddy to exist, it relies upon the configuration and dynamic patterns forming from its sub-systems as well as for

the observer to define its boundaries. The river provides the flow of water, but it is the small sub-systems - the rocks, crooks along the riverbank, and fallen trees – that allow the eddy to emerge. The system is too chaotic to map enough initial conditions that engineering efforts are risk free. A single act taken to enhance or take advantage of the eddy may destroy the dynamic pattern and leave only straight current. To extend the metaphor of unintended consequences, the removal of the log that resulted in the destruction of the eddy may in turn deliver unintended consequences to a farmer down-stream.

Social science is rife with unintended consequences particularly due to its nonlinear, open system nature. The traditional paradigm offers an outcome-based perspective which is ill-equipped at predicting unintended consequences or in informing responses to a dynamic and complex environment (See Forrester, 1971; Rittel and Webber, 1973; Holling, 1973).

The challenge that the complex, dynamic nature of fields presents to researchers has been stated clearly by numerous scholars, most notably by W. Richard Scott. And, these challenges apply to not just the study of fields, but to the nature of the discipline itself. Emirbayer (1997) calls this challenge “a fundamental dilemma for sociologists today”. The challenges include the problem of boundary specification, the difficulty in analyzing the relational, dynamic processes that transform social structures, the appropriate application of causality, and the normative implications to which features of dynamic objects are lost once they are reified. For social systems, the ability to “unfreeze” static, substantialist categories that deny fluidity becomes a moral consideration.

"Transactional thinking, in a word, deconstructs a taken-for-granted moral universe" (Emirbayer, 1997, 309).

This research "unpacks" the taken-for-granted moral universe of the American, public K-12 field of education by applying a paradigmatic lens from which a normal science rooted in the paradigm of complexity can be modeled. Currently, traditional normal science is constrained in its ability to engage with the nonlinear, open system quality of fields. One can see their dynamic behavior, observe their emergent features, but, using the traditional paradigm leaves one stuck with language deficiencies and inadequate mechanical metaphors by the vestiges of the linear, closed system paradigm.

A theoretical framework sufficient to explain and describe fields, objects whose boundaries are in time as much if not more than in space, is needed. This research aims directly for that target, filling an expressed need within the discipline of organizational theory. Scholars have built volumes of work looking at institutional change, but each pursuit, even though operating at the field level, is unique to its empirical space (Dacin, Goodstein, Scott, 2002). Another way to say this is that there is little theory holding these studies together as a body of work. Davis and Marquis (2005) present empirical evidence that "[W]ith the notable exception of population ecologists, macro-organizational scholars since 1990 have largely abandoned the idea of cumulative work within a paradigm in favor of problem-driven work that is theoretically agnostic" (334).

Why the institutional field of education is a good test case

Education is a classic wicked problem in multiple senses (Rittel and Webber, 1973; Jordan, Kleinsasser and Roe, 2014). The most important of Rittel and Webber's (1973) properties of wickedness for this inquiry is the problem of framing. Defining the problem,

"improve the educational system" for example, requires a contextual framework that recognizes a deficiency. As Rittel and Webber (1973) explain, "To find the problem is thus the same thing as finding the solution; the problem can't be defined until the solution has been found" (161). For example, "test scores are too low" defines the problem in terms of its solution. Wicked problems are also defined within a social context. Solutions are not right or wrong. Rather solutions must be judged as good or bad, and varying stakeholders necessarily judge solutions in varying contexts.

> Diverse values are held by different groups of individuals-- that what satisfies one may be abhorrent to another, that what comprises problem-solution for one is problem-generation for another. Under such circumstances, and in the absence of an overriding social theory or an overriding social ethic, there is no gainsaying which group is right and which should have its ends served (Rittel and Webber, 1973, p.169).

Because education is so deeply embedded in society, there are precious few outcomes valued by all stakeholders but there is a vast landscape of values to which a given policy risks individual injury.

Public K-12 education is an *institution* in that the processes and procedures involved have created a "social reality" within the community of stakeholders and entered what Selznick (1992) calls "thick" institutionalism (p. 235). The informal structures that develop around the formal procedures and rules add a layer of texture which includes the values and interests of those involved in the social reality of the institution. Public K-12 education is also a series of semiautonomous bureaucracies with independent jurisdictions all pursuing similar ends and involving similarly trained professionals. This larger systemic category reflects what scholars have called an *institutional field or organizational*

field (DiMaggio and Powell, 1983).

The efforts of the education reform movement over the last thirty-five years in America have affected nearly all facets of public K-12 education. The institution of public K-12 education in America has experienced dramatic changes and continued structural turbulence as it collectively struggles to implement reform (Chubb and Hoover Institution on War, Revolution, Peace, 2009). Initiated in response to this reform movement, in 2001 federal legislation called *No Child Left Behind* added significant turbulence to this already complex, multijurisdictional, and deeply embedded institution and its institutional field. Much of this turbulence is a result of new problems emerging as a result of the reforms themselves (Jordan, Kleinsasser and Roe, 2014; Ravitch, 2010).

Scholars trying to understand patterns of relationships and patterns of structural changes across institutionalized organizations have introduced the concept of *institutional fields* and *isomorphic mechanisms* as pressures that homogenize structural aspects of organizations within the institutional field (DiMaggio and Powell, 1983). Recent historical trends across the institutional field, at the federal, state, and local levels, including moves toward bureaucratic centralization and test-based performance measures, exhibit the characteristics of isomorphic pressure and isomorphic change across the institutional field (Carolan, 2008).

At the federal level, *No Child Left Behind* (NCLB), passed in 2001, was a national reform making individual schools accountable to the federal government for student performance through a series of requirements tying federal funding to student test scores. Schools became responsible for ensuring that student scores on standardized tests met

required benchmarks or risked being labeled a failing school and potentially closed. States were also required to allow charter schools to operate. Competing for students, called "school choice", introduced a market dynamic to promote competitive creativity. Some states experimented with incentivizing success with merit pay to teachers or schools who achieved the highest student test scores (NCLB, 2002).

The policies and agenda of the reform movement encountered significant political resistance from various groups on a variety of issues (Ravitch, 2010) and subsequent legislation has rolled back or shifted some of the accountability requirements (ESEA, 2016). Despite the rollback, the peculiarities of the reform movement's outcome-based and market-oriented approach left a persistent imprint on the structures defining and supporting the institution. Now, polarized, often frustrated communities - parents, teachers, administrators, citizens, and lawmakers - are left trying to agree what a stable public education system *should* look like and how to reach agreement between individuals and groups with a history of conflict (Ravitch, 2010; Jordan, Kleinsasser and Roe, 2014).

Paradigms

The methodology developed in this research requires a paradigmatic view of the institutional field of public K-12 education in America as a fluid, ever evolving pattern within society and contrasts that view with a paradigmatic view of institutions as means to an end, a mechanism for producing specific outputs. Because the concept of "paradigm" is central to the overall purpose of this project, I provide a detailed explanation of the definitions, meanings, and constructs of the concept of paradigm as I intend them within the context of institutional theory. The overview and definitions will form the context for

the ontological and epistemological issues considered.

Thomas Kuhn, in his landmark work, The Structure of Scientific Revolutions, defines a paradigm as "some accepted examples of scientific practice – examples which include law, theory, application, and instrumentation together – provide models from which spring particular coherent traditions of scientific research" (Kuhn, 1996, p.10).

Although I am guided by Kuhn's formulation of paradigms and remain faithful to my understanding of his concept, the list of critiques aiming at his claims is vast and very little time is devoted to those criticisms, although some clarifications regarding the idea of incommensurability are necessary. Because this research does not generally respond to the larger body of criticisms, the definitions and meanings intended are my own interpretations and narrowly related to this research. The terms this research considers foundational are *paradigm*, *normal science, incommensurability*, *anomaly*, and *paradigm shift*. Of these terms, paradigm, normal science, and anomaly bear the heaviest load.

Complexity is commonly referred to as a paradigm by researchers who are working out ways to understand social behavior as a complex adaptive system as well as researchers working on other applications of complex adaptive systems (Parreira & Silva, 2021; Sigahi, Rampasso, Anholon & Sznelwar, 2023; Bubak & Jacek, 2019; Castañeda, 2020). It has not escaped interested parties, at least those with a philosophical bent, that in many encounters with the word *paradigm,* its use appears gratuitous, fashionable, appended primarily to provide additional flair to an idea. It sometimes feels as if the author expects the audience to treat the so labeled material as somewhat mystical, clearly *better*, but omits the tangible, practical reasons to invoke the specter of Kuhn. That is not the case here. My

purpose is utilitarian. I use the concept of paradigms as a tool or navigational aid. Paradigms help us build models and theory to suggest what the effect of an action will be. They provide the assumptions for normal science to work out into useful models.

Paradigm: if-then sequences

I define a ***paradigm*** in very broad terms as a particular type of modeling construct with the quality that people can use a paradigm to produce if-then sequences in the form of predictions: IF (assumption x) THEN (we should see result y). Narrowing the parameters, testing hypotheses, whether by verification, falsification, or consilience principles, can only be done within a paradigm. The given assumptions of a paradigm dictate the measurements that can be predicted. The units, subjects, objects, the definitions used are all parts of the paradigm. A paradigm also informs those employing it of places to look for puzzles to solve.

For example, once someone decides that Earth revolves around the sun, they can learn more about the sun and the other planets to understand what Earth is likely to do and what dangers or opportunities that information presents. Before they decide that Earth revolves around the sun, they have no way to ask the kinds of questions that assumption creates. The *model* which assumes heliocentrism predicts that *if* the planets all revolve around the sun, *then* the distances of each planet from each other should be relative to each planet's distance from the sun and its position within its orbit around the sun. Applying verification principles, interested parties can predict things like solar eclipses from the model itself (rather than from periodicity) and verify the model's predictions. Applying falsification principles, they can predict locations based on the model and measure locations relative to Earth, the sun, and the other planets. If the model were flawed, those

measurements would fail to match the predictions. Applying consilience principles, the interested parties could determine all the consilient theories that support the model like gravitational equations, theories of planet formation, and theories about the behavior of light through telescopes and note the perfect agreement between the theories and the measurements taken through each.

In each case, the models and their inherent assumptions constitute the *ifs* that allow users to hypothesize a series of *thens*. Those if-then structures become the content of what Kuhn calls *normal science*. A moment's consideration makes it clear that the units, subjects, objects, and definitions follow from the assumptions of the paradigm -the *ifs* - regardless of whether some of those may overlap with other paradigms.

Normal Science - the process of carrying out if-then sequences to validate, improve, or overturn the model

In this research, ***normal science*** is defined as the testing and carrying out of if-then sequences discovered through application of the paradigm. Using reason, investigators can deduce the way the unexplored parts of the system *should* work and use the schematic quality of the paradigm to make predictions which can then be refined through experiment and the process of normal science.

Normal science is puzzle-solving science and is made possible by the paradigm itself. The work of normal science is what makes a paradigm as a structure of inquiry successful. Normal science naturally utilizes the potential of the paradigm to generate if-then hypotheses, and only through the process of normal science is it even possible to discover the anomalies and exceptions potentially requiring a new paradigm.

Paradigm shift - anomalies overburden the model so a new model is needed

Eventually, inconsistencies and anomalies turn up in the course of normal science. At first, those inconsistencies are dealt with as exceptions, each getting its own special rule or workaround to make it fit within the overall paradigm. Eventually, that collection of workarounds gets especially cumbersome, and a new paradigm is proposed that solves some particularly vexing anomaly or set of anomalies. The new paradigm uses a structurally different set of assumptions that produce different if-then sequences, rendering nearly all the older if-then sequences not just obsolete, but largely meaningless because the foundational assumptions are no longer meaningful.

The classic example is the development of our understanding of space and time. To our ancestors not equipped with geometry and the ability to travel fairly large distances, Earth is flat. It is what is now called *locally Euclidian*, meaning that within human scales, an observer cannot measure Earth's curvature and two parallel lines will not cross. The ocean appears flat to an observer on a boat. This being the case, it is not surprising that so many ancient cosmologies assumed a flat, fixed firmament. Lacking adequate transportation options, using that assumption actually produced the best possible results.

The Greeks developed their geometry from that assumption of a fixed firmament, proposing a static and rigid world that was tremendously useful to those who wished to navigate its surface from fixed reference points and build sturdy structures. Time too had fixed reference points under this paradigm. Using a new invention, the telescope, Galileo's observations suggested that the sun was the center of the solar system rather than Earth. Galileo also realized that motion was relative to the observer's frame of reference. Shortly thereafter, Newton's calculus and gravitational equations provided a model that resolved

Galileo's observations and ushered in a new, heliocentric paradigm with a mechanical, clockwork-like universe where relative local reference frames all existed within a universal time and universal space. This paradigm proved extremely useful for engineering and ushered in the machine age. A few centuries later James Clerk Maxwell devised his famous equations describing electromagnetism. Unfortunately, these equations suggested that light always moved at a constant velocity regardless of the motion of the observer which was not consistent with anything the clockwork mechanical paradigm of Galileo and Newton could account for. Einstein's relativity resolved that anomaly by recognizing that time and space themselves were relative to the observer, ushering in another new paradigm of information and space travel.

In each of these paradigm shifts, anomalies which did not fit the available ifs of the prior if-then sequences eventually required entirely new models that accounted for the previous models as well as the anomalies. The new models instituted new if-then possibilities simply because the models made different assumptions. The ifs from one model are different from those of another. This means that there are statements each model is capable of making which make little or no sense in another paradigmatic model simply because the assumptions are different.

Incommensurability

Within this research, ***incommensurable*** concepts are defined as concepts that are clearly expressible using only one of the set of assumptions. To describe the effects of phlogiston, one must have a language that defines phlogiston. To describe the properties of oxygen, one must have a language that defines oxygen. Many of the same cause-effect

relationships can be described using either paradigm and its related theories with acceptable, even indistinguishable predictive success. However, the theories cannot coexist in a single frame of reference because they start with different sets of assumptions about the fundamental nature of the subject matter. To offer a social science example, how can an interested party use the construct of the divine right of kings today now that social relationships are seen through the lens of the social compact? Divine right does not mean anything substantive now because it is simply no longer assumed a divine right to rule is a valid concept anymore. An interested party knows that even a king must keep his end of a particular bargain with the population or eventually he will lose the legitimacy of his title and will be deposed.

Surely the ideas composing modern conceptions of legitimacy were nominally understood by competent rulers of the pre-enlightenment period. The threat of peasant revolt meant at the very least loss of material resources. The loss of peasants and crops through war too meant loss of material resources. In whatever language the exchange of protection for labor was couched, the western idea of the social compact was generally meaningless before the enlightenment because the conceptual framework of the divine right of kings, however convenient it might have been to the king, is simply a different way to understand the relationship of the ruler to the ruled. Either framework could doubtlessly be used to understand the relationship, but that understanding provides different options to those holding different views and informs different courses of action. To the king believing in the divine right of kings, the question is one of how to be a good king. To the king who believes in the social compact, the question is one of how to be a

good politician.

Of all the critiques directed at Kuhn's work, the most emphatic are inevitably directed towards his notion of incommensurability. Since the concept is going to be useful to the development of alternate paradigms in this research, I will address a limited critique to both sidestep a major theme within that criticism and expand on why the idea of incommensurability will be useful in this research.

The proposition has occasionally been put forth that incommensurability must be total to be valid, to be anything more than some mere gestalt, that either there is no possible way to judge statements made using one paradigm while employing another, or science does not suffer from incommensurability between paradigms. Furthermore, because paradigm shifts follow no obvious direction, there can be no absolute truth if one were to accept incommensurability. One could never really know how close a paradigm matched objectivity because objectivity would be a property of the paradigm rather than of external reality. Thus, it could be entirely legitimate to claim that what is true for me may not be true for you because we may be using different paradigms. At the core of this objection lies a flat refusal to entertain the proposal that objectivity in science cannot be firmly established, that the models humans create could be based on how humans have learned to look at our external reality rather than on what they are looking at. That sort of relativism seems to be at the top of a slippery slope where reality itself falls apart into some sort of shattered philosophical idealism where each mind is its own potential universe.

While that is perhaps somewhat a caricature of the argument, the mere hint of the claim that objectivity may be an illusion generated by familiarity makes some philosophers

who want to preserve some notion of scientific realism very uncomfortable.

Donald Davidson, a prominent philosopher known for his ontological model, *anomalous monism*, wrote a famous article called *On the Very Idea of a Conceptual Scheme* (1973) taking aim at the whole notion of conceptual relativism, saying things like, "Kuhn is brilliant at saying what things were like before the revolution using - what else? - our post-revolutionary idiom" (p.6). But his argument seems to be directed at something of a strawman. He considers two cases, complete and partial failure to translate. In both cases, according to Davidson, there is some range of ideas which would simply not be translatable whatsoever. After demonstrating his proof that translation is theoretically always possible if we can recognize communication, he considers the matter closed.

Nicholas Maxwell (2014) called incommensurability, "Kuhn's worst mistake" (p.133), pointing out that Michael Faraday solved the problem of incommensurability by inventing a new language that was neutral to the old.

> Faraday solved the problem by inventing, in collaboration with William Whewell and others, a whole series of observational terms deliberately designed to be neutral between the competing theories. Thus were born the terms we use today: electrode, electrolyte, electrolysis, anode, cathode, ion, anion, cation" (p.134).
>
> Maxwell's sub-thesis is that "[t]his strategy of Faraday's can always succeed, I claim, whenever there are competing theories about the same, or overlapping, phenomena. It will always be possible to concoct observational terms that are neutral between the two theories, and which can be used to describe phenomena that constitute crucial experiments intended to decide between the two theories" (p.134).

I believe these arguments and others that follow similar lines of objection miss the point quite substantially. The question is not whether an individual *can* translate between paradigms given the foundational assumptions of each; the question is whether new

paradigms can emerge which require such translation. If they can and do, then one can never assume that the current paradigm represents the best set of assumptions. The question of whether objective truth even can exist is clearly not within the scope of this research, but it raises a critical issue. Whether or not each successive paradigm may or may not bring us closer to some objective truth, one cannot know the assumptions a new paradigm will use before it is developed. This leaves only the option to try to identify the foundational assumptions of the paradigm as closely as possible in order that interested parties may recognize when anomalies challenge those assumptions. The reason Kuhn, as Davidson put it, used our "post-revolutionary idiom" to tell us what things were like before the revolution was because the post-revolutionary idiom was available. Had the post-revolutionary idiom not been available, the exercise would have been meaningless in every sense of the term.

The reason Faraday was able to develop the "neutral language" was because it was clear that some prior assumptions were inadequate to understand the phenomena he was investigating. When those assumptions prevent one from even asking a question because that question would make no sense following the if-then process, one cannot discover a neutral language. However, I included Maxwell's (2014) critique because it suggests an important option when dealing with anomalies. If it is recognized that a set of data or theory fits uncomfortably within the general framework, then, by looking for a neutral descriptive language, interested parties may have a tool at their disposal to go about assessing which assumptions may be preventing those anomalies from submitting to the if-then process of our normal science. Social science is, in many ways, better positioned

than the physical sciences for such a search because social scientists know that our objectivity is always colored. We are used to using models designed for particular purposes and do not demand, or in most cases expect, consilience between our models.

Interestingly, Buddhist thought seems to have a similar concept of paradigms using a different terminology. The Dalai Lama (2005), explaining a seventh century Buddhist scholar's ideas, puts it this way,

> when we relate to the empirical world of experience, so long as we do not invest things with independent, intrinsic existence, notions of causation, identity and difference and the principles of logic will continue to remain tenable. However, their validity is limited to the relative framework of conventional truth (p.68)

Anomalies only present themselves in the context of the current paradigm. The reason anomalies are anomalies is that they do not fit within the current paradigm. They are typically treated as exceptions to expectations and given special rules. Eventually, according to Kuhn, these anomalies build up until the special rules, or kludges as they might be called, demand a different set of if-then assumptions that can accommodate the anomalies.

This special role of anomalies in paradigm development suggests three distinct ideas. The first two are self-evident, but the third requires a little bit of elaboration.

1. There is direction to paradigm development, but that direction doesn't move toward objectivity, rather toward usefulness.
2. Usefulness is easily confused with 'true' in an ontological sense.
3. There is an objective way to measure one paradigm against another.

While it is not clear that pure objectivity in a third person sense or "God's eye view" even could exist fully free of paradigmatic framing, by simply doing away with the

argument for some absolute objectivity it becomes clear that paradigms are oriented toward utility. One can easily compare and rank paradigms based on the utility our observations have suggested. A paradigm under this perspective can be understood as a kind of navigational aid.

What is or may be possible to achieve follows from the if-then nature of the paradigm. If one can achieve that possibility through the application of Paradigm A, then they can say that Paradigm A successfully enabled them to achieve that possibility. Furthermore, if Paradigm B fails to suggest the same possibility or suggests a possibility which fails and that failure is predicted by Paradigm A, then one can say that Paradigm A is a superior paradigm for that purpose. If I assume a flat Earth under Paradigm B and try to travel to the edge and look over, I will fail to find the edge. What seems possible but fails under Paradigm B was predicted to fail under Paradigm A which assumes a globe. Furthermore, if I try to circumnavigate that globe, I can succeed. Paradigm A can be said to be better at producing more potential choices based on its if-then properties and so is a better paradigm. It is impossible to navigate around a flat Earth so that choice and others which follow from a spherical planet are simply not available in Paradigm B.

Clearly there is a vast gray area where people could still argue that their paradigm is better based on nebulous or entirely internally subjective criteria, but the ability to share information must be taken as a requirement. For that reason, it is imperative that a proposed paradigm issue be supported with the specific anomalies which the old paradigm has uncovered, the assumptions which made that set of observations appear anomalous, and the assumptions which can transcend the old assumptions.

Once alerted to the failures of one set of assumptions and the virtues of another, the next step is to demonstrate improved utility under the new paradigm. It must improve navigation or it has not reached a stage where it can support its own normal science and displace the old. The new paradigm must illustrate specific utility or clear potential of specific utility before it has value as a research tool since research is normal science which operates under a paradigm.

It would be possible, even easy perhaps, to convince the king that the social compact provided a functional model which might even be superior in some instances in strategizing. But the king, having grown up understanding his rule as being a divine right and being surrounded with others who also framed the situation as divine right, would have a host of metaphors drawn from the religious ideas of his time. His foundational belief, that kingship was bestowed on him by God, would have to change for him to change the basic modeling process he used to strategize. Furthermore, that strategy would always include at some level the question of where his authority ultimately derived from and that could be a major sticking point. However, those monarchs who recognized the *utility* of the social compact model were in a much better position to accommodate the social revolution which followed the enlightenment. Those who stuck fast to their divine right might not have been able to comprehend that a peasant revolt could form an actual government and the idea could spread, leaving them little in the way of options when confronted with a revolutionary anomaly.

Anomalies - special case, need for new paradigm (incommensurability)

The concept of a paradigm offers a unique analytical tool for identifying generalizable utility - classes of problems that *can be* addressed - inherent in a particular

modeling logic. Interested parties can identify the landscape of problems our science is *constructed to solve.* That landscape will have a particular structure inherent in a paradigm.

As an existing paradigm matures, research within that paradigm begins to identify a class or classes of problems Kuhn calls *anomalies* which are particularly frustrating and appear unsolvable. The problems in these classes both need to be and cannot be solved under the paradigm. Usually, this isn't a clear problem with the paradigm, so the anomaly is given a status as a 'special case'. Wicked problems are at least partly *the result* of attempts to engineer solutions to problems defined by a group with a narrow interest (Termeer, Dewulf, & Biesbroek, (2019). Wicked problems are seen as a 'special case' of problems within the traditional paradigm. Figure 1 below illustrates the paradigmatic approach where paradigm and normal science occasionally encounter a "special case" or anomaly.

A Paradigmatic Approach

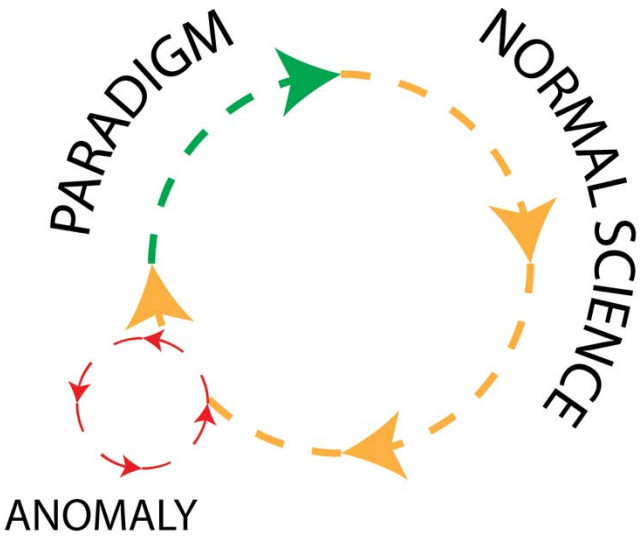

Figure 1: Illustration of A Paradigmatic Approach and a list of the 3 anomalies related to institutional theory.

Some anomalies can point us toward problems that are not just particularly frustrating but which our models are *not constructed to solve*. Occasionally, the anomalies present a problem that cannot adequately be solved with a 'special case' and we are alerted to the potential need for a new paradigm. Figure 1 lists three such anomalies the traditional paradigm has encountered: 'wicked' problems, the counterintuitive and unpredictable behavior of feedback, and system collapse when systems are highly efficient. Once identified, paradigmatic anomalies alert us that we encountered a landscape where our prior definitions fail, where a problem cannot be defined adequately, or where we are consistently being surprised by unintended consequences.

Incorporating complexity

Since the publication of Gleick's (1987) classic book, *Chaos: Making a New Science*, researchers and authors in a wide array of disciplines have taken up the topic of complexity and produced a wide body of work. Many consider complexity a new paradigm in the Kuhnian sense (see Kuhn,1996). But issues of complexity were already pressing concerns, and cross discipline research into problems associated with complexity has made powerful waves in sometimes siloed academia. What has been learned is that the wickedness of wicked problems cannot be escaped. They are systemic. Attempts to engineer the way out of them, to control at finer and finer levels of detail, are futile. What modelers externalize is what they also do not see and some of it will eventually make itself apparent through positive, amplifying feedback as new problems.

As Holling (1973) made so clear, highlighting the anomaly of state flip or collapse in his example of forest management, managing for maximum sustained output makes the system more rigid and increases the likelihood of system collapse, or state flip. As Forrester (1971) showed, highlighting the anomaly of the counterintuitive nature of feedback in his affordable housing example, by creating affordable housing where it is most needed, policy makers unintentionally create areas of high poverty and few job prospects which in turn amplifies the causes of poverty. As Rittel and Webber (1973) illustrated so vividly in their description of the anomaly that they call wicked problems, distributed, systemic problems with unique local conditions are unamenable to strategic, outcome-based solutions across the whole system. Solving one problem creates another. Solutions are not just likely to fail, they are *guaranteed* to fail under strict boundary conditions. The anomalies described here show that there is a common theme to all of

them. They are all defined by boundary issues; they are deeply dynamic; and all of them have unpredictable behaviors.

The anomalous problems we encounter require a new language to describe an alien landscape, a landscape where the anomalous problems make sense and are even expected, and the technology or methodology to address those problems informs a normal science dedicated to mapping that landscape. Transformational change to deal with these anomalies requires new constructs, new tools, and a new paradigmatic map to chart a new course appropriate to deal with the anomalies in a fundamentally new way.

The anomalies addressed in this research all share three qualities that are native to objects understood through the lens of complexity. In each of the anomalies listed earlier, the starting conditions cannot be known, the boundaries cannot be clearly defined, and there is no stable equilibrium.

Ontological Issues -reification (permanence vs persistence)

The subtitle of this dissertation is "an institutional field under a complexity paradigm". In order to explain the significance of that statement, it is necessary to compare the traditional paradigm to the complexity paradigm, so it is clear what assumptions I am using to frame the visualizations that follow in Part Three, and what makes those assumptions distinct.

There is deep division among academics regarding the empirical nature of the objects of scientific study. When Emile Durkheim suggested researchers study "social facts as things" (Durkheim, 1895, 1982), the resulting reification of society and social patterns placed a large portion of sociological scholarship alongside the study of biological entities such as plants, animals, and cells. Social pattern developed boundaries and purpose

like living entities. Living organisms function for survival, as does society. Living systems have integrity and persistence as do social organizations. But reification of social facts is not as simple as it might seem. At what level can a systemic whole be empirically identified? Conversely, at what level is meaning socially constructed?

Many systems theorists are sharply critical of assigning scientific status to nebulous entities. Checkland (1999), seeking to draw a distinction between a 'hard' and 'soft' systems approach, summarizes part of the reification issue with the graphic shown in Figure 2.

Hard and Soft Systems

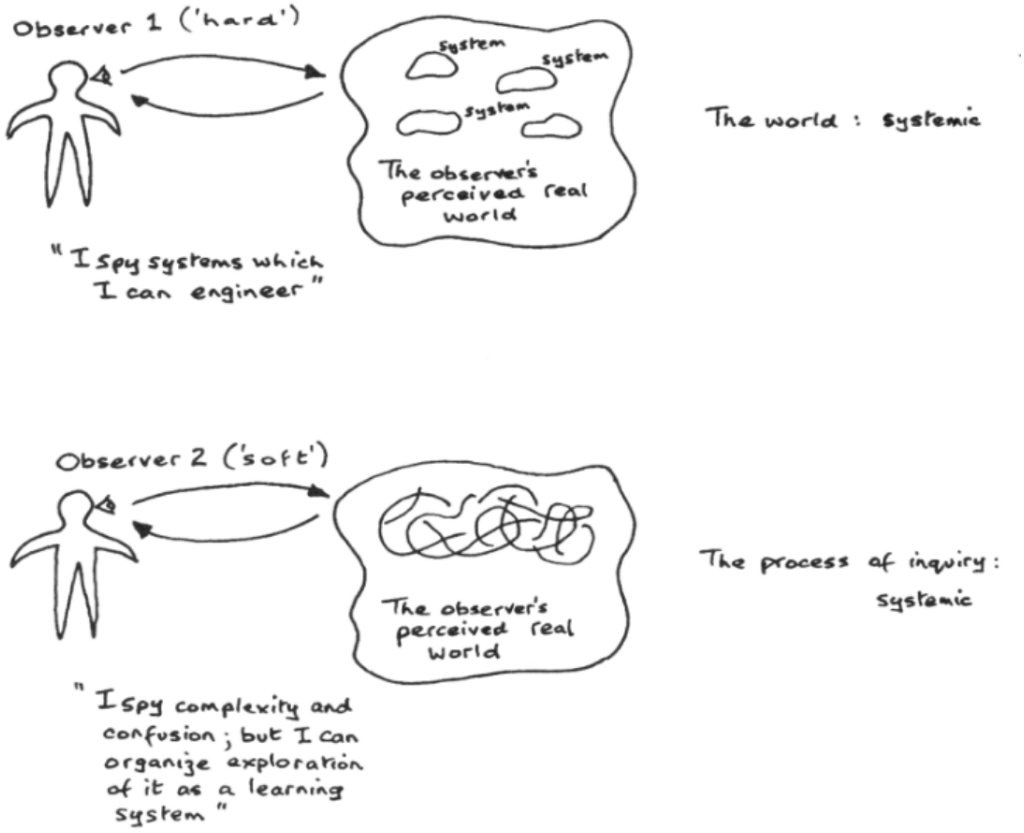

Figure 2: Drawing taken from Soft Systems Methodology: a 30-year retrospective by Peter Checkland (1999, p. A11).

This research bridges Checkland's divide (seen in Figure 2) by defining the reification process instrumentally for social systems and placing that process within a modeling context generally and a systems context specifically. The main idea established through this argument is that the ambiguity stems from unidentified assumptions regarding permanence and persistence and can be overcome by assigning permanence to a linearizing, closed systems view and persistence to a nonlinear, complex systems view.

The foundational difference between the paradigms is grounded in the ideas of permanence vs persistence. "Things" under a complexity paradigm are patterns in time, like an eddy, rather than objects with an ideal form which deteriorate like a brick. In a traditional paradigm, anything that persists longer than its purpose demands is reified as permanent. Under a complexity paradigm, permanence is essentially meaningless. Rather we have persistence of patterns in time.

The two paradigms contrasted in this research have been given many names. Margaret Wheatley (2006) names them Newtonian versus Non-Newtonian. Fritjof Kapra (1997) calls them Newtonian vs systemic as does Ervin Laszlo (1996). We can also call them linear versus nonlinear or systems versus engineering. When posed in juxtaposition in this research, the terms used will be *linear and nonlinear*. But when referring solely to the paradigm being constructed here, it will be called the *complexity paradigm* and its counterpart may be referred to as the traditional paradigm. The critical distinction between the two paradigms is the wholesale replacement of the term *permanence* from the linear paradigm with the word *persistence* in the nonlinear paradigm.

I will avoid using the term systemic to refer to paradigmatic views because a great deal of systems science has historically been rooted in a permanence-based ontology. Even so, a persistence-based paradigm is systemic. Permanence corresponds with the linear and Newtonian paradigms. Persistence corresponds with nonlinearity, complexity, and the non-Newtonian paradigm. Permanence and Persistence are ontological qualities attached to 'things' through the reification process. Linearity and Nonlinearity are epistemological qualities which follow from the paradigmatic axioms. These will be the subjects of the following sections.

Table 1 highlights some of the foundational differences between the linear or traditional paradigm and the complexity paradigm. The table compares the differences between "Permanence" versus "Persistence".

Comparing features of Permanence verses Persistence

Permanence (linearizing)	Persistence(nonlinear complexity)
• Objects	• Processes and relationships
• Control for feedback loops & therefore no consideration of what is externalized	• Identify feedback loops & therefore considers what is being externalized
• Engineering	• Resilience & Sustainability
• Problem to Solution (How can we…)	• Overall system: butterfly effect, unintended consequences (how might we..)
• Linear, stable equilibrium	• Nonlinear, feedback loops & dynamic equilibrium
• Outcome based	• Planning & trade off's
• Framing to persuade	• Framing to deliberate
• See object/schematic (things hold still)	• See landscape as interaction (things are dynamic)
• Wicked problems are external to the system	• Wicked problems are within the system
• Problems are external	• Problems are internal

Table 1: A comparison between the features of "Permanence" on left and "Persistence" on right.

Normal science proceeds from the respective paradigms in substantially different directions. The linear paradigm is an engineering paradigm and focuses on causality. It requires reasonably clear goals, well defined boundaries, and analyzes systems of inputs and outputs. Efficiency under a linear paradigm is a clear relationship between inputs and outputs and is always connected to the goal, whether implied or explicit. Sustainability under a linear paradigm is stable equilibrium, expressible as consumption at some volume that is less than or equal to the maximum sustainable outputs from a resource base. Using that logic, efficiency is the only way to increase outputs sustainably once the resource base is fully utilized. The resource base is regarded as external to the system until it is converted to inputs.

Under conditions where goals are clear and resources are known, engineering is a critical and valuable process, providing solutions to many problems. But in modern society, it has become painfully clear that engineering a solution is a process that fits within a broader scope of environmental effect. Public engineering projects almost always include processes for mitigating the consequences of implementing an engineering solution. So too are organization policies enacted within a broader scope of external effect. Under conditions where adaptation of one entity changes the landscape which forces other aspects of the landscape to adapt which further changes the landscape and the access to available resources, inputs and outputs in an endless cycle, an engineering-based paradigm is often the cause of perceived problems (Rittel and Weber, 1973; Holling, 1973; Forrester, 1971).

Epistemological Concerns

I draw heavily from the literature on complex, adaptive systems theory for this research. Complex, adaptive systems are open, nonlinear systems. These kinds of systems

operate though permeable boundaries within their environment. When researchers frame institutional fields as open systems, they can be thought of as structured patterns of events in time with varying persistence rather than as static things (Koliba, Meek and Zia, 2011). L. von Bertalanffy (1950) was one of the first to bring modern systems thinking to the U.S. (Koliba et al., 2011) where he advanced the concept of the organism as an open system, pointing out through his example that the critical trait of a system is that its emergent qualities are more than the sum of its parts, or 'the whole is more than the sum of its parts'. The system itself is a unique thing. Open systems as a framework recognize environmental forces which "shape, support, and infiltrate organizations" (Scott and Davis, 2007, p.31).

Epistemological Issues - systems models as engineering schematics

A major point of criticism leveled at efforts to apply systems models to social systems involves the epistemological demands of a mathematically rigorous discipline with its roots in the physical sciences. In modeling physical systems, there is only one logic: the relationships between elements are the laws of physics. Causality, though implicitly playing a different role in complex adaptive systems view than in a linearized Newtonian view, is much easier to uncritically accept as inherent in a physical system.

Even in a complex physical model with chaotic properties, like a climate model, the unknowns consist primarily of initial conditions. Predictions can be expressed in confidence levels commensurate with the number and measurement of initial conditions. But in a social system, models typically predict the aggregate of human behavior as outcomes. Strict causal mechanisms are unavailable, even in principle, because there are simply too many elements involved with too much feedback. Researchers have no choice but to develop laws which govern that behavior in order to predict policy outcomes.

Traditionally, this has involved the various versions of rational choice theory which require, or at least strongly favor, some form of methodological individualism as described by Weber (1978) and Parsons (1967).

Translating System Thinking and Logics

Systems thinking includes assumptions that do not always mesh well with methodological individualism in many cases. Properties of a whole are not reducible to the sum of its parts, and cross-scale dynamics affect the overall system, making causality more than merely elusive in complex, dynamic systems. A systems view of the world sees a hierarchy of subsystems all functioning together to produce the behavior of the whole.

From an institutional standpoint, one needs to factor in more than the rationality of those involved. They need to account for institutional values, institutional effectiveness, physical resources and structures, social pressures as demands or guidance relating to institutional ends and means, and other factors that all play into what amounts to causative roles. From a systems view, rational choices are, in fact, responsive to and dependent on the dynamic environment and vice-versa.

This is a critical distinction. Under a complexity paradigm, one cannot aggregate the behavior of actors to predict the behavior of the system because they cannot disaggregate them first. Feedback is counterintuitive; there is always something being externalized; and behavior cannot be described in stable equilibrium terminology. While there are certainly actors, and in institutional fields, actors make up the bulk of singular elements of which the field is comprised, the behavior of the field involves field level complexity and so the prize of a complexity paradigm cannot be a causal model that will inform decision makers of the outcomes of their choices.

The prize of a model based in the complexity paradigm instead successfully measures, monitors, and visualize the behavior of systems and their directionality. Traditional examples of this idea are path dependence in political science and increasing returns in economics. Both are well-studied phenomena now understood as systemic properties resulting from positive feedback (Pierson, 2000; Arthur, 1994). Path dependence and increasing returns refer to the tendency of emergent patterns to persist and the role of positive feedback in the emergence and development of those patterns. A complexity paradigm *can* inform system models that identify persistent behavior as directional in relation to the persistence of an identified pattern. In this sense, complexity does inform predictive models. But the nature of what is predictable is fundamentally different.

Boundaries and Equilibrium

Systems are defined by their boundaries. When a person names a thing "Thing 1" which they perceive through their senses in the environment, they are generally naming a pattern that persists in time. That pattern is the product of the dynamic behavior of different constituent things (themselves also persistent patterns of other things) which are not "Thing 1". This relationship of parts to whole describes the idea of "wholeness", which is the defining feature of a system (Checkland,1999; Esmark, 2011; Meadows and Wright, 2008, Holland, 2012).

The boundary of the pattern in most cases actually is the definition of "Thing 1" as a system. Think of an eddy in flowing water. Eddy is a noun - a thing. And yet an eddy is clearly not static, not permanent, nor does it persist in the same way we normally understand persistence. In the environment, all things that can be named and delineated

are persistent patterns of dynamic activity, even a brick. If an interested party is concerned with time scales much shorter than the average persistence of "Thing 1", then its dynamic nature is irrelevant to their purposes, and they may consider it a static and permanent entity in its own right with no need to consider the system which produces the persistent pattern. Doing so linearizes aspects of the resulting model by externalizing factors of change. As the level of complexity in the larger system rises around stable systems, however, their own stability is less assured (see Holling, 1973). This overview suggests a hierarchy placing permanence as a reification concept into a very small subset of persistence as a reification concept since persistence internalizes what permanence externalizes.

The utility of the traditional paradigm is its ability to linearize a process to achieve an outcome with the greatest efficiency. The signature of the traditional paradigm is the requirement that boundaries and outcomes be clearly defined. In social science, there are two clear expressions of this assumption, the notion of ceteris paribus and the concept of Pareto optimum.

Ceteris paribus translates from the Latin as 'all things being equal' and equates to "assuming the same starting conditions, we can change one variable and see what happens to the system". This is not a systemic reality. There is no single causal structure in a complex system.

In the traditional paradigm, equilibrium is seen as an end point, a solution. If you achieve equilibrium in a linear framework, you achieve *stable* equilibrium. Pareto equilibrium or Pareto optimum is among the best-known examples of this framing.

Pareto optimum is achieved when no more changes to the system can be made without causing harm to some member of the system. It is a "best of all possible worlds" concept, a theoretical point of arrival. In such a theoretical best possible world, the system stops changing. It has arrived at its optimal point and continues from there on converting inputs to outputs in its perfectly stable way.

A complexity paradigm, in contrast, treats equilibrium as dynamic rather than as stable. The futility in pursuing a goal of stable equilibrium is addressed in a revolutionary 1973 paper by C.S. Holling titled, "Resilience and Stability of Ecological Systems". Although Holling's paper is situated in ecology, his context is management of complex systems and it was the spark that brought the word "resilience" into current management practices and changed our understanding of stable equilibrium entirely, changing both the idea of stability and the idea of equilibrium. Using examples of forest and fisheries management, he showed how managing a complex system to produce the maximum sustainable yield weakens the system's ability to recover from perturbations and makes system collapse far more likely.

More fundamentally, Holling showed that stable equilibrium is not actually a behavior exhibited by complex adaptive systems. It is an engineering concept applicable to linearized systems with defined boundaries. In the linear paradigm, equilibrium is seen as an end point, a solution. If you achieve equilibrium in a linear framework, you achieve *stable* equilibrium. Holling's thesis (1973), quoted below, turns out to be obvious in hindsight but is still very hard to incorporate into our models.

> An equilibrium centered view is essentially static and provides little insight into the transient behavior of systems that are not near the equilibrium. Natural, undisturbed

> systems are likely to be continually in a transient state; they will be equally so under the influence of man. As man's numbers and economic demands increase, his use of resources shifts equilibrium states and moves populations away from equilibria. The present concerns for pollution and endangered species are specific signals that the well-being of the world is not [21] adequately described by concentrating on equilibria and conditions near them. Moreover, strategies based upon these two different views of the world might well be antagonistic. It is at least conceivable that the effective and responsible effort to provide a maximum sustained yield from a fish population or a nonfluctuating supply of water from a watershed (both equilibrium centered views) might paradoxically increase the chance for extinctions (p.2).

Holling takes away the key pillar of a linear paradigm, efficiency. By externalizing elements of a system that seem to harm a maximum yield strategy, like spraying for bugs and planting the desired kind of tree, the system becomes rigid and prone to collapse of what Holling calls a "domain of attraction" when an otherwise unremarkable disturbance affects the rigid system. This phenomenon has come to be called "state flip" and it will be explored more in Part Four. Holling's research strongly suggests that managing for efficiency, managing for highest sustained yield, reduces the resilience of a system to absorb disturbances, reorganize, and adapt while maintaining its basic structure, function, and feedback mechanisms. The concept of resilience recognizes that adaptive systems are dynamic and can experience disturbances that disrupt their equilibrium, but they have the capacity to recover and adapt over time. A linearized, efficient system, say an automobile, will simply break and need repair. But when a dynamic system has moved to a new domain of attraction, it's gone. It cannot be repaired.

The institutional field as a three-dimensional landscape

While open systems are fundamentally dynamic, they are often observed in their steady state. This observation may lead one to model them as static objects or as closed

systems, independent of their environments, externalizing qualities not included in the schematic view. As von Bertalanffy (1950) describes, even within the flux of processes, "[e]very organic system appears stationary if considered from a certain point of view; but if we go a step deeper, we find that this maintenance involves continuous change of the systems of next lower order" (p.27). In this sense, every organic system is essentially a hierarchical order of processes standing in dynamic, evolving equilibrium (von Bertalanffy, 1950, Scott and Davis, 2007). Thus, one can understand and model many systems as both static and dynamic processes.

To draw a comparison, static snapshots are outcomes and are the procedural end of the goal formulation-execution process in an outcome oriented, linear ontology. That does not mean that in a complexity paradigm they do not exist, just that they are an arbitrary point in an ever-adapting landscape. There is no permanence to the snapshot although some aspects of the state of affairs it describes may persist for some time. Again, this is a clear illustration of how the linear paradigm is included within and transcended by the complexity paradigm. As an example, a leader can structure an organization according to an organization chart, seeing that as the definition of the organization in its context. At the same time, the legacy of an individual in the organization can be considered, noticing what changes to the organization their tenure brought. David Snowden (2015) describes it this way,

> In effect the current state of the system represents its dispositions, the nature of the definable elements in the system and its propensities. In a complex adaptive system we do not see linear material cause; that is the big conceptual switch that too many thinkers and practitioners miss in the engineering-dominated metaphors and models of systems dynamics. (p.42)

The prize for successful models in the linear paradigm is the ability to predict effects from causes and so inform policy decision-makers how to achieve desired outcomes. The tricky part of the process, assuming such predictive power were granted, involves the process of deciding which outcomes to pursue. And, because an "ought" cannot be derived from an "is", it is easier to consider intentional, goal-formulation processes separately, extrinsic to the functional schematic to varying extents.

That separation is one of the main critiques of traditional functionalist accounts. Agency and structure have historically proven difficult to reconcile in a grand theory functionalist model. Participants in the debate argue over whether, because intention/agency is non-deterministic, one can or cannot justify a lens that suggests a level of determinism, as well as whether or not a particular approach actually qualifies as deterministic (Lane, 1999, 2000, 2001a, 2001b; Giddens, 1977, 1979, 1984; Storpor, 1997; Isajiw, 1968).

A related debate addresses the integration of power dynamics. Many functionalist accounts, especially those aiming at grand theory (Durkheim, Parsons, and Merton chief among those), are characterized as framing the systemic functioning of society as producing harmony and social stability when all is good, and when unstable or unharmonious configurations are encountered, those configurations are called dysfunctional, tarring the troubles faced by marginalized groups with the label, dysfunctional, deepening the systemic barriers keeping those groups marginalized (Walby, 2007; Zinn, 1990). Lenses matter.

Anthony Giddens (1979, 1984) theory of structuration is perhaps the most notable effort to reconcile the agency versus structure differences within a grand theory. While the approaches employed in this research to integrate strategy and structure addresses the propositions laid out above, in doing so, it also owes an intellectual debt to Gidden's concept of duality of structure (Giddens, 1984).

> Structure, as recursively organized sets of rules and resources, is out of time and space, save in its instantiations and co-ordinations as memory traces, and is marked by the 'absence of the subject'. The social systems in which structure is recursively implicated, on the contrary, comprise the situated activities of human agents, reproduced across time and space. Analyzing the structuration of social systems means studying the modes in which such systems, grounded in the knowledgeable activities of situated actors who draw upon rules and resources in the diversity of action contexts, are produced and reproduced in interaction. ...The constitution of agents and structures are not two independently given sets of phenomena, a dualism, but represent a duality. According to the notion of duality of structure, the structural properties of social systems are both medium and outcome of the practices they recursively organize (p.25).

Because complex, nonlinear systems theory is based on abstracted relationship types, albeit with a grand theory of systemic relationships (Lane, 2001a), rather than a grand theory about the system under consideration, applying systems principles to model observable systems is, at its foundational level, an empirical endeavor with pragmatic, utilitarian aims. The product is either useful or not. What is reified is the system, not the parts. Even so, modeling complex, nonlinear systems is not like modeling a designed system with linearization applied to the paths from inputs to outputs to improve the efficiency of the process.

Institutional Field as Signals and Boundaries

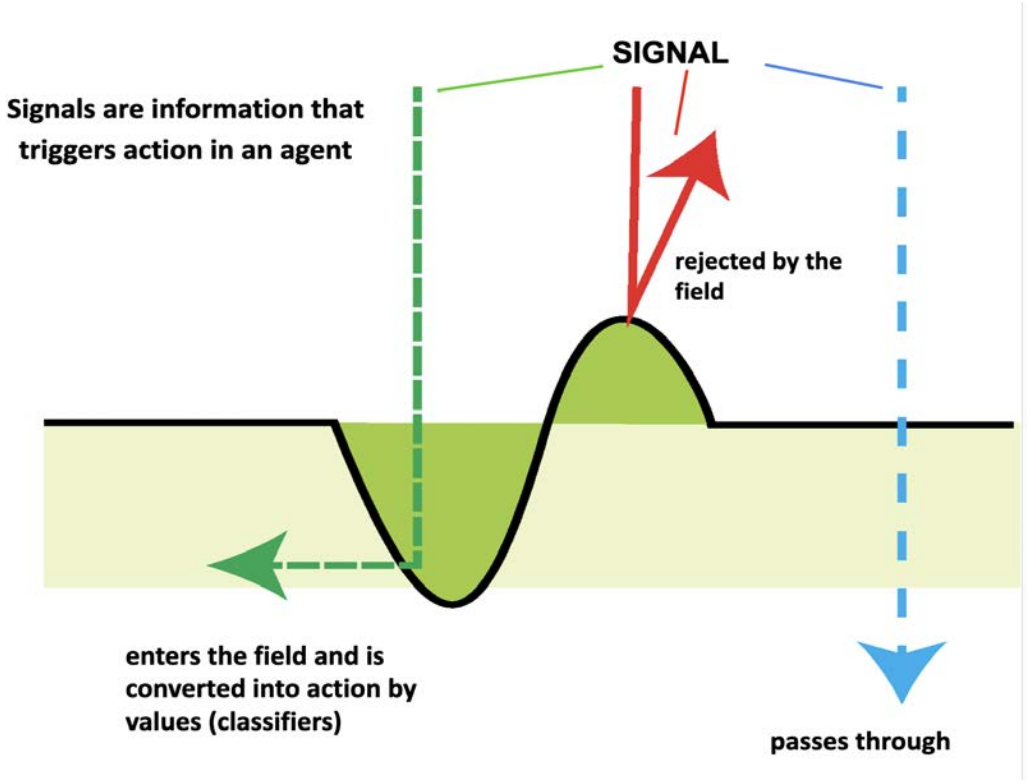

Figure 3: Illustration of a 2-dimensional view of the institutional field and the behavior of signals.

Signals and Boundaries

In his book, Signals and Boundaries (2012), John Holland, one of the pioneers in the topics of complexity and complex adaptive systems, suggested that, "[e]cosystems, governments, biological cells, and complex adaptive systems [CAS] in general are characterized by intricate hierarchical arrangements of boundaries and signals" (p.1). He goes on to lay out several strategies for studying CAS by analyzing their signals and boundaries.

Since this research relies heavily on Holland's framework, a summary of how I interpret his work is in order. Looking at Figure 3, signals are information that triggers

action in an agent through classifiers, and boundaries describe the relationship of signals to the system. There are two distinct issues involved in this idea of boundary: 1) signals which the system rejects and signals to which the system is transparent involve externalized boundaries. 2) Signals which *are* processed by the system also represent a kind of boundary in that the agents processing that signal are within the system or are members of competing systems. At a field level, agents that process a signal to which the field will generate a response are all within the field. This last point is why my operational definition of the institutional field is "a landscape upon which values compete for legitimacy."

Holland offers several examples of boundaries and signals. From physical walls to policy dictates, boundaries are defined largely by the signals that are not allowed into the system while signals that do enter the system are converted into action. Our skin and immune system make an obvious physical boundary rejecting certain pathogens while our mouth and digestive system offer a specialized pathway to process food into energy. The externalized parts are outside, and the internalized parts are inside.

Because CAS are hierarchically bounded, that is, subsystems exhibit signal processing and boundaries and the collection of subsystems at higher levels also exhibit signal processing and boundaries, methodological individualism as a strategy does not work. The agents in this agent-based system are humans, but their aggregation as families, neighborhoods, organizations, and institutions is a process of increasing complexity. Additionally, we do not need to know which agents process which information, just which information the field is processing, even though it is agents processing the information.

While various flavors of rational choice related theories attempt to model an essentially reductionist landscape, aggregating individual choices to arrive at the likely behavior of the larger unit of society under consideration, using agent-based models under Holland's schema is explicitly not useful for making predictions about the aggregate behavior of real-world systems. Holland (2012) explains,

> Though the book makes substantial use of data and examples, its objective is not to produce models that make specific predictions from data. Instead, its objective is to examine the mechanisms that underpin the development of hierarchies of signals and boundaries in complex adaptive systems." (p.2)

Rather he produces CAS using computer modeling by creating the seeds of the systems and watching the emergent patterns for commonalities in order to uncover an "overarching framework that suggests ways to steer complex adaptive systems by modifying signal/boundary hierarchies" (p.2).

Because the emergent patterns are nonlinear, no two models taken from real world data will produce the same emergent timeline. There is no way to linearize this process. However, there are ways to define the processes wherein agents produce processing of signal. Holland (2006) offers a summary of what 'classifier systems' are in an agent context:

> To study cas formally, we must provide a way of precisely defining the component agents and their interactions. Each agent in this model is specified by a set of conditional (IF/THEN), signal-passing rules. The IF part of the rule "looks for" certain signals; if these signals are present, the THEN part specifies a signal to be sent. More carefully, the IF part consists of a set of conditions where each condition specifies a class of signals; if any signal of the specified class is present the condition is said to be satisfied. If all of the rule's conditions are satisfied, then the rule is said to be satisfied. Many rules can be satisfied simultaneously, so they compete to send the signals specified by their THEN part. Moreover, more than one rule can win the competition, so several rules can send signals simultaneously. There is no danger of internal conflict between rules, because additional active rules

> simply broadcast additional signals. This "parallelism" is an important feature: An agent can compose its actions from a combination of rules, rather than requiring a specific rule for each possible situation The formal specification of a signal-passing system of this kind is called a classifier system (cfs)[2]. (p.4)

For the purposes of this research in a real-world context, values as described above form such a classifier system.

In my earlier definition of the institutional field, I defined the boundary of an institutional field as *all individuals who possess values that serve to convert signal into action*. In many ways, defining the boundary serves to define the field itself. Nevertheless, the higher-level definition of *a landscape upon which a category of values competes for legitimacy* is important from a paradigmatic sense because it reflects the adaptive nature of that landscape, its metaphors requiring the shift from permanence to persistence. In this way, saying *the structure of the field is comprised of those values that have been institutionalized or codified in law, policy, habit, myth or ceremony* clearly refers to a process and submits to snapshots in time rather than to an ideal or permanent condition.

The category of values that define the field are those which inform behavior related to the institutional purpose, but that boundary should be partly objective rather than purely derived from familiarity. In other words, we should be able to sample some aspect of the field, given basic assumptions of the institutional purpose, and determine what values the institutional field is converting into action as well as define the agents who hold the "if-then classifier," the value, which is tuned to the particular signal and has a mechanism for converting it to action.

John Holland (2006, 2012), developed the machine learning model called classifier systems. Classifier systems treat agents as the fundamental units of a complex adaptive system. The agent is defined as the unit that employs rules of interaction with other units and the rules themselves evolve as the system adapts so “agent” here is level independent. The rules are what Holland calls ‘classifiers’ that evolve over time to respond to complex input through a process of selection, crossover, and mutation. A classifier consists of conditions and actions. Conditions describe the input conditions under which the classifier should be activated, and actions specify the response or output associated with the classifier.

The actual rules, “classifiers”, evolve or adapt through a reinforcement learning mechanism. When an input signal is received, the classifiers whose conditions match the input produce an output. Among the activated classifiers, those that contributed to a combined action which allowed the system to persist or to grow are selected. Selected classifiers reproduce through a process of crossover and mutation, producing new classifiers with combinations of attributes from the parent classifiers. The strength of a classifier indicates how well it performs on problem instances. Classifiers that contribute to correct solutions are rewarded with increased strength, while those contributing to incorrect solutions experience reduced strength. This reinforcement mechanism guides the evolution of the population towards better solutions.

Each of those parts, signal, value and action, will have a degree of impact on the field which is unique to the individual’s position within the field. But in a CAS, the butterfly effect is ever present so all signal processing which feeds back into the field has

the potential to change the field in dramatic ways. Still, it needs to be noted that leadership roles have a broader impact than other individual agents in many or most cases than those non-leadership roles.

Some clarifying examples: First, in the institutional field of national defense, most signals pass through most of society with no comprehension of its meaning. If a particular weapons system gets appropriated by Congress, that signal has no mechanism to convert to action for most citizens. But to the contractors who will build the system, the signal triggers rapid and intense action, while among competitors it might also trigger action. Among members of the appropriations committee and the defense department, it is converted into different action, but it is both captured and understood. Second, the institution has been successful at creating boundaries to negative signals. In large part, public outcry over defense appropriations is kept out of the field and aggressive steps keep information inside from leaking outside to become a signal to would-be protestors. Most of the population doesn't vote based on defense appropriations except in the most vague and general terms. War, however, broadcasts a signal that substantially expands the number of agents who are triggered to respond. But even war usually fails to break through the boundaries surrounding the military-industrial complex. I use the institutional field of national defense here because it is an easy example to see that the field can be defined by individuals who have the correct classifier systems to process that signal.

Education, on the other hand, is an expansive institutional field affecting most of society to varying degrees and soliciting input from a broad cross-section of the population. Some federal policies may send very little signal to local districts, schools, parent-teacher

associations, and neighbors, while other federal policies might become signals that are processed by almost everyone in the country. Clearly the institutional field of public education is huge. For this reason, it makes sense that any analysis of signals and boundaries should be done at a given hierarchical level and attempt to define the signals and boundaries *at that level*. If the research were to explore the interaction between levels, it is likely each level would need its own analysis first.

Seeing the institutional field topologically

Thus far, the landscape has been described as a two-dimensional space, and in Part Two, this landscape is viewed from above. But, what creates the features of the landscape? Notice in Figure 4 below how the value applied to a signal affects the topology in this two-dimensional graphic. The depth or height of the field reflects the interaction of signal and value. If the value is negative, the field acts as a barrier, in this visualization, a hill. If the value is positive, the field processes the signal (measured as topics) into action, represented as a basin or valley.

Topographical Features of the Institutional Field

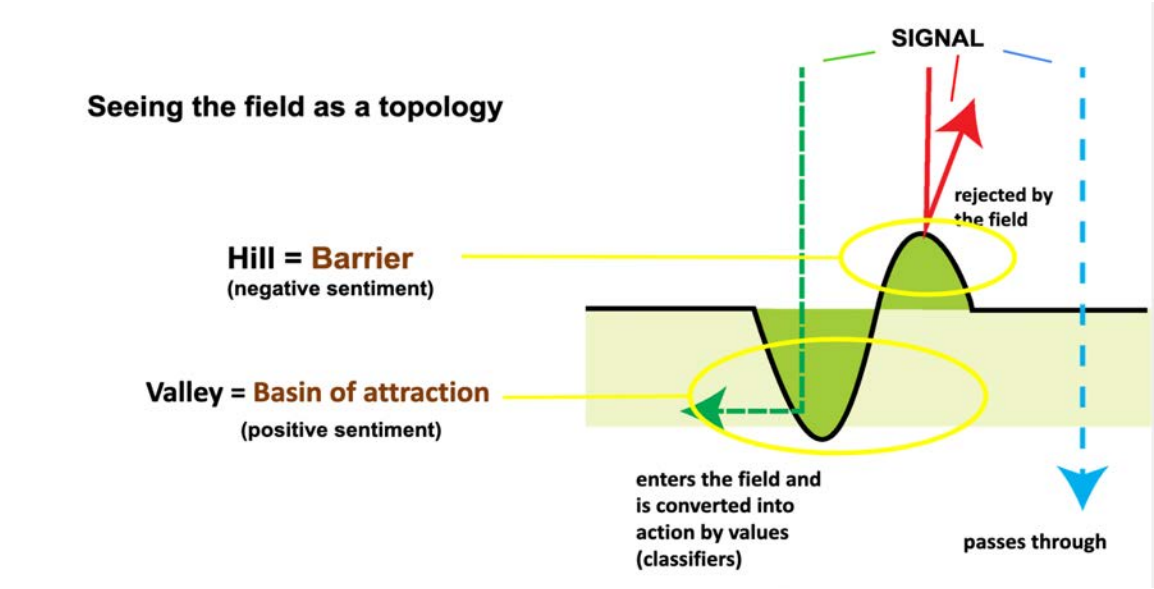

Figure 4: Illustration of a two-dimensional view of the institutional field and the topographical features created by the behavior of the signal.

Four-dimensional view of the institutional field: Patterns in time from Pareto optimal to wicked problems

The institutional field is dynamic. Modeling the landscape as dynamic requires the addition of time. Because this written document only allows for a view of the three-dimensional image, the dynamic nature of the field will require some of the reader's imagination. The image below has a link to an animation of a dynamic topological landscape (Herdy, M., n.d.). This particular image is of a fitness landscape (borrowed from ecology) but it describes the same fundamental structure of an institutional field in three-dimensions. The sequenced images in Figure 6 provide a glimpse into the visualization as animated stills.

Example of An Institutional Field using a Fitness Landscape

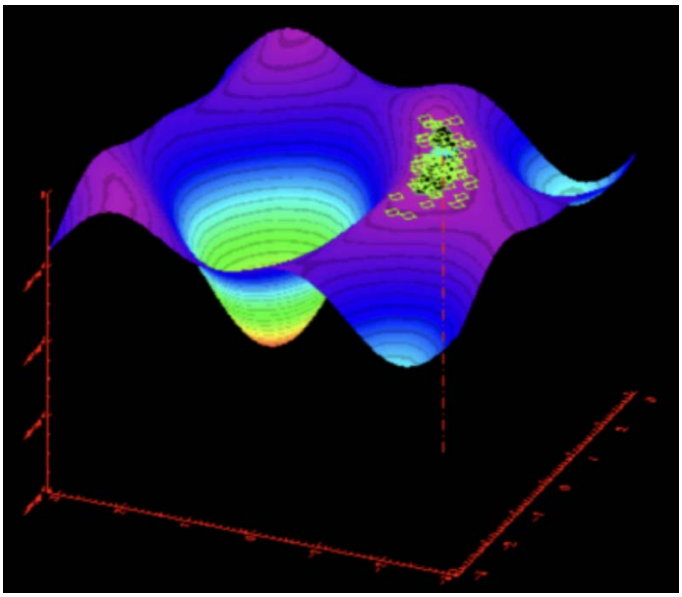

Figure 5 Screenshot of a computer generated image of a fitness landscape. This image serves as an example of a landscape of an institutional field. Original animation by Herdy, M. (n.d.)

Imagining this image (Figure 5) as a three-dimensional schematic view of the institutional field, we can see the parts, the signals being processed as hills and valleys. Those hills and valleys can be clearly identified with topic modeling and refined with other techniques including hand coding and sentiment analysis.

Using this static visualization, could you imagine it might be possible to try to engineer a perfect/ideal state of values and signals in Pareto optimum - as good as it can be where no more good can happen and we would like it to remain in this state forever? That is not possible in an actual complex adaptive system because it is always changing. Evolution is its nature and cannot be arrested without destroying the system.

Animated Stills of a Dynamic Institutional Field

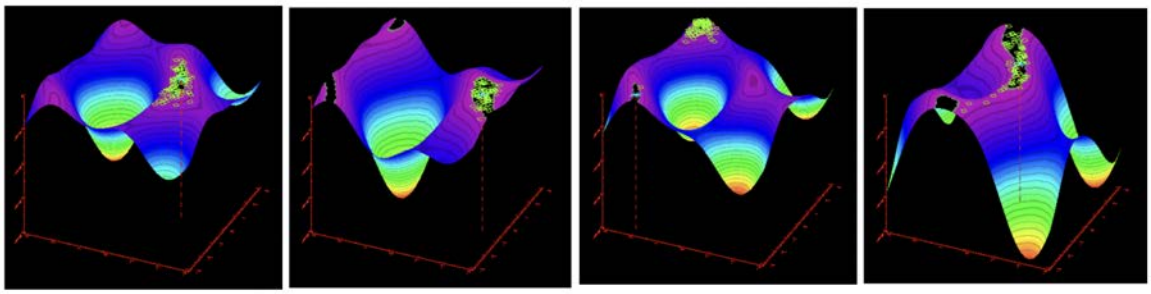

Figure 6: Each still is a screenshot capture of the animated fitness landscape shown in Figure 4 above. Notice the changing landscape when viewing the frames from left to right. The original animation is by M. Herdy (n.d.).

Figure 6 depicts the animated institutional field as still frame images. If read from left to right, the movement of the field comes to life. These images are a screen capture of M. Herdy's (n.d.) dynamic fitness landscape. By seeing the dynamic behavior of the system, it is clear that each action affects other actions producing new signals and the environment changes also producing new signals and the feedback is ever evolving. Living systems grow, they never end up in a static equilibrium. There is no end point. There is no stable boundary. There are no initial conditions - and all things can never be equal. What are called "wicked problems" in the traditional paradigm do not even properly have an analog in a complexity paradigm. They are just "the landscape". Ceteris paribus and stable, "perfect" solutions are also almost meaningless in a dynamic adaptive landscape.

The goal of this research is to visualize an institutional field. Now that the reader has an understanding of the paradigm and what this research aims to achieve in terms of a model, a fitness landscape using signals and boundaries, I want to summarize Part One by clarifying the adaptive institutional topology theory (AITT).

Adaptive Institutional Topology Theory

The concepts presented in Part One are used to operationalize and visualize the institutional field offered from the case study of American, public K-12 education. In order to reference the ideas from Part One collectively, justifying the requirement that an institutional field must be measured by its values and modeled as a topology, I offer the name Adaptive Institutional Topology Theory[1] (AITT).

AITT is based on the propositions regarding values presented earlier and interprets those propositions within a complex adaptive system framework, in particular the signals, boundaries, and classifier terminology adopted in this work. By assuming that values are the mechanisms that capture information as signals and convert the signal into behavior, we can understand the behavior of the system through the proxy of values. By understanding the institution as a field defined by its values with persistence rather than permanence as its reifying principle, it becomes a landscape where values compete for legitimacy which then define the boundaries of the institutional field.

The structure of the field is comprised of those values that have been institutionalized or codified in law, policy, habit, myth or ceremony. The category of values that define the field are those which inform behavior related to the institutional purpose. The physical, geographical boundary of an institutional field is all individuals who possess values that serve to convert signals processed by the field into action. The behavior of the field can be viewed in two distinct ways; first as the response to signals

[1] Adaptive Institutional Topology Theory is introduced as a novel theory in this research.

that trigger the institutionalized values to generate action within the field, and second as the change in values within the field over time. The notion of agency required for a competition of values to occur is omitted intentionally. What matters are the values and the responses.

For AITT to work, the visualization must be that of a dynamic landscape. Otherwise, the axioms of the traditional paradigm will misguide the researcher searching for a specific outcome and the benefits generated from the methods will not be fully or accurately represented. And AITT is scale independent. For this reason, the researcher using AITT must identify both the level of organization as well as the aspect of the field under investigation. No one corpus or dataset will fully describe the complexity of signals available to the field. To gain a deeper and richer understanding of the field under examination, multiple corpuses need to be individually analyzed and then compared in further steps of analysis.

The following case study is an example of how AITT can be used in researching, modeling, and visualizing an institutional field.

Part Two: Methodology Grounded in Complexity

This section uses tools and methods grounded within complexity science to model and visualize an institutional field. The primary goal focuses on identifying and capturing the signals being processed by the field and modeling the changes in the institutional field of public K-12 education during a period of significant change. The time period is between 1998, the leading up to the No Child Left Behind Act of 2001, and 2004, the period following its initial implementation. In order to identify patterns within the dataset, this research will employ machine learning.

How the unit of analysis is operationalized

The institutional field is operationalized according to the definition given in Part One: a landscape upon which a category of values competes for legitimacy. The structure of the field is composed of those values that have been institutionalized or codified in law, policy, habit, myth or ceremony. The category of values which define the field are those that inform behavior related to the institutional purpose. A static snapshot of the field would be a collection of those values that have been institutionalized or codified in law, policy, habit, myth or ceremony and would be analogous to a photograph of an eddy. The dynamics of the field involve the competition for legitimacy among values and are analogous to the river flow as a system contributing to the persistence of an eddy.

Field level processes shape micro and meso processes, and vice versa (Thornton et al., 2012). From a systems perspective, fields offer a holistic account of the processes that shape and are shaped by individual elements of the system. Observing the system in operation *redirects our attention from the output of the system to the system itself*. Since the field itself is a pattern in time, an eddy rather than a brick to use the metaphor from

Part One, researchers need to look for fundamentally dynamic properties which fix themselves at varying levels of persistence rather than structures which can be abstracted from time like an organization chart or a flow chart.

Because institutionalization involves the infusion of values into the organizational structures (Selznick, 1996) and the field is an emergent property of human behavior regarding a particular category of institutional pursuit (in this case, pursuing the category of public K-12 education) mediated through norms, roles, and legitimized authority (Berger and Luckmann, 1967; Selznick, 1996), this research identifies the occurrence of those values that were competing for legitimacy within the field during the specified time period and plot their frequency over time as an indication of change within the institutional field.

Process of model making

The process of model making begins with a decision about the corpus chosen for investigation. An institutional field is not only a product of multi-jurisdictional and multi-level interactions. It can also be understood through the wide variety of narratives appearing in various sectors and publications: federal, state, and local legislation and policies, transcriptions of legislative hearings, government reports, published academic literature and studies, video transcripts of meetings, written testimony, documentaries, promotional material, and reports and studies from philanthropic organizations, nonprofits, foundations, and professional associations to name a few.

The corpus that represents the sector of the field for the purpose of this research is the public narrative captured in the discourse of widely distributed newspaper publications. This is a limitation of this study and can be broadened to incorporate other levels of

discourse in future research that builds on the model presented here. Other publications in such a corpus could include the narratives within local school districts or state level narratives of various sorts. Critically, each corpus provides the values of its own sector. To broaden the scope would likely involve studying multiple sectors independently, comparing the results, and combining the results to see into a single visualization. This is a proof of concept; therefore, that process is left for future research to resolve.

Once the corpus is gathered, the signals that are being included in the institutional field must be identified. To do this, the machine learning tool of topic modeling was used so that topics, captured as patterns within the corpus, could be analyzed and organized into themes. Topic models capture the main ideas that are recurring patterns in the corpus. These patterns represent the signals the field is accepting, contesting, or debating that can be seen as hills or valleys in the graphic once the value disposition is known. This process is shown in Figure 7 along the top of the graphic.

To gain a deeper understanding of the topics and the values of classifiers that are found within the field, a close read of the text was conducted. In examining the processed topic model, articles were selected based on their high relevance to the topic. Sentiment analysis can also provide additional insight into the disposition of the values within the field, giving them the negative or positive directionality in the topology of the field's landscape. Sentiment analysis is a machine learning tool that identifies individual sentences to discover the sentiment for keywords that are selected by the researcher.

Process of Model Making

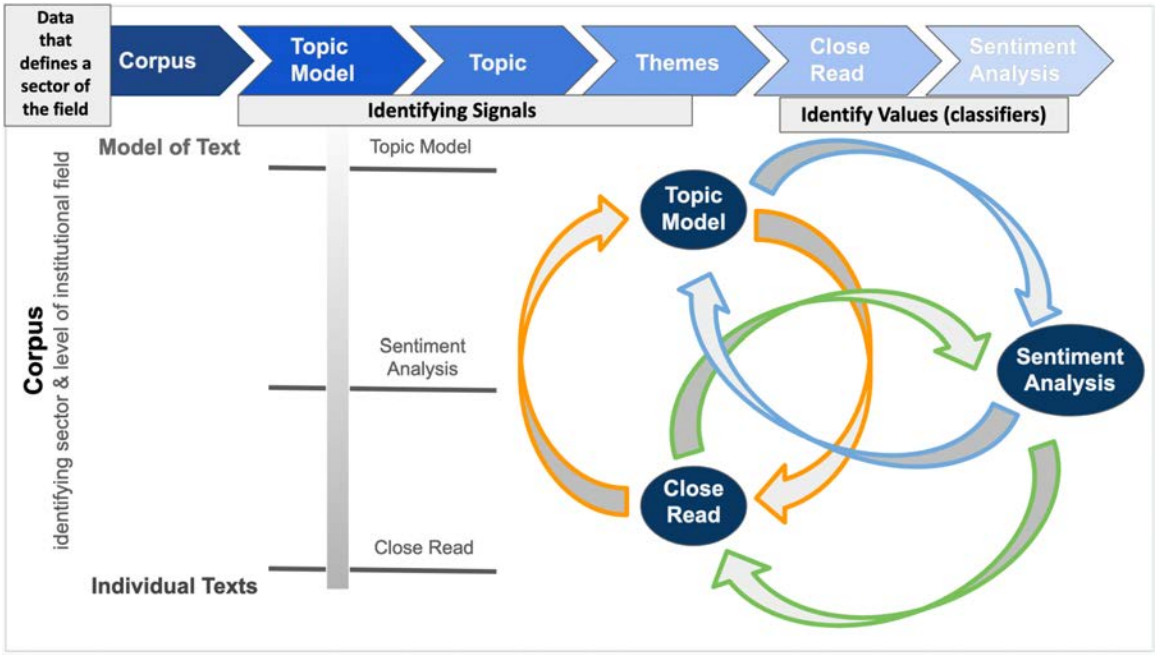

Figure 7: Graphic showing the process used to discover the signals being processed by the institutional field, the topology of the field, and the close read of the narrative.

Even though the process is presented in a linear format at the top of the graphic, it does not need to follow a specific order. In general, it is the researcher's choice as to the order in which the information is discovered. Ultimately, this is an iterative process where any one of these methods can be a starting point and lead to the other methods. And, while the methods of machine learning such as topic models and sentiment analysis are able to detect patterns within the probability space, the interpretation of those patterns must be made by a content expert or researcher. While the model provides indicators toward where the researcher may want to direct attention, it is left to the researcher or content expert to apply their lived experience, breadth of knowledge, and use the contextual clues to make sense of what the model identifies as those emergent patterns of the system itself.

Research design

The research is designed around a holistic, single-case design (Yin, 2003) using the qualitative inquiry paradigm of constructivism (Guba and Lincoln, 2005). The rationale supporting the single-case design, according to Yin (2003), is based on how the case is being used. This case study represents "a critical case in testing a well formulated theory" (Yin, 2003, p. 40). Theory, in this case, is used in a broad manner to encompass not only theory, but the paradigm from which theory is based. As Yin (2003) explains, "[t]he single case can then be used to determine whether a theory's propositions are correct or whether some alternative set of explanations might be more relevant" (p.40).

The data is explained through the paradigmatic lens of complexity. Elements of the analysis include the ontological and epistemological assumptions and the institutional structures and mechanisms developed in the previous section that are relevant to the level of institutional organization.

Each paradigm is operationalized differently, and the paradigm of complexity directs the methodology presented here. The linear paradigm can be seen in elements of the narrative that are mechanism-oriented and outcome-based. The nonlinear paradigm focuses on internalized and externalized factors and signs of increased pressure dynamics on the overall system as feedback. The linear paradigm favors a causal mechanism orientation or outcome-based approach, aligning more closely with aspects of the brick metaphor introduced in Part One. The nonlinear paradigm follows the logic of the eddy, identifying the dynamic field as a persistent basin of attraction where values interact, compete, and establish legitimacy or illegitimacy.

Credibility of this qualitative inquiry adheres to the elements for credibility as outlined by Patton (2002) such as rigorous methods; credibility of the researcher; and philosophical belief in the value of qualitative inquiry. As Patton (2002) elaborates,

> The thread that runs through this discussion of credibility is the importance of intellectual rigor, professional integrity, and methodological competence. There are no simple formulas or clear-cut rules about how to do a credible, high-quality analysis. The task is to do one's best to make sense of things. A qualitative analyst returns to the data over and over again to see if the constructs, categories, explanations, and interpretations make sense, if they really reflect the nature of the phenomena. Creativity, intellectual rigor, perseverance, insight – these are the intangibles that go beyond the routine application of scientific procedures. (p. 570)

This research uses a constructivist approach that is oriented toward "the production of a reconstructed understanding of the social world. The traditional positivist's criteria of internal and external validity are replaced by such terms as trust-worthiness and authenticity" (Guba & Lincoln, 2005, p. 184).

Furthermore, the generalizability of this study lies not in the story the data reveals about the empirical reality, but in the application of a research methodology grounded in the paradigm presented. How researchers construct their understanding of the world around them informs them of what they seek to further investigate and the questions they develop and use to investigate our world. This research aims to offer a paradigmatic explanation of our world that provides new and different information to the participant engaged in employing the paradigm of complexity. It is not that the empirical reality changes, but the information available to the observer changes depending upon their frame of reference or the paradigm they choose to use. The goal here is to "do justice to the particular case before looking for patterns across cases" (Patton, 2002, p.582). According to Stake (1978, as quoted in Patton, 2002, p. 583),

> what becomes useful understanding is a full and thorough knowledge of the particular, recognizing it also in new and foreign contexts. That knowledge is a form of generalization too, not scientific induction but naturalistic generalization, arrived at by recognizing the similarities of objects and issues in and out of context and by sensing the natural covariations of happenings. To generalize this way is to be both intuitive and empirical. (p. 6)

This investigation follows Guba and Lincoln's recommendation that "to argue that it is paradigms that are in contention is probably less useful than to probe where and how paradigms exhibit confluence and where and how they exhibit differences, controversies, and contradictions" (Guba and Lincoln, 2005, p. 192). The expected result of the contrasting explanations is an identification of unambiguous differentiators and degrees of incommensurability between explanatory processes. The case study leads to some clarity regarding which aspects of the institutional field each paradigm explains more easily.

Methodology:

Discourse Analysis

Once a justification *that* the identification of values in texts has been established as the goal, the question becomes *how* to identify those values and *what* texts to extract those values from. Discourse analysis offers significant value in this process. By integrating concepts from discourse analysis and institutional theory, Phillips et al. (2004) construct a model of the relationships among texts, discourse, and institutions.

Their starting premise is that "it is not action per se that provides the basis for institutionalization but, rather, the texts that describe and communicate those actions […] [D]iscourses provide the socially constituted, self-regulating mechanisms that enact institutions and shape individual behavior" (Phillips et al., 2004, p. 635), p. 635). The discourse presents narratives and, from those narratives, values can be extracted. From

these values, researchers can model the institutional dynamics or "actions" expressed within the institutional field.

As a foundational methodology, this research relies upon the discourse analysis methodology as presented by Phillips et al. (2004). This methodology provides both guidance on the data gathering process and identifies impacts of discourse on institutionalization (see Figure 8). The authors present seven propositions that will not be tested in this study but will be used as potential mechanisms linking the text and discourse to institutional processes such as legitimacy and diffusion. The institution is affected through discourse, action is affected by discourse and the institution as well as actions affect discourse in return. "From a discourse analytic perspective, an institutional field is not characterized simply by a set of shared institutions but also by a shared set of discourses that constitute these institutions and the related mechanisms that regulate nonadoption" (Phillips et al., 2004, p. 647) The institutional field is particularly complex because it holds "multiple sets of more or less structured discourses holding in place institutions that constrain and enable behavior of actors across the field" (Phillips et al., 2004, p. 647).

Discourse and Institutions

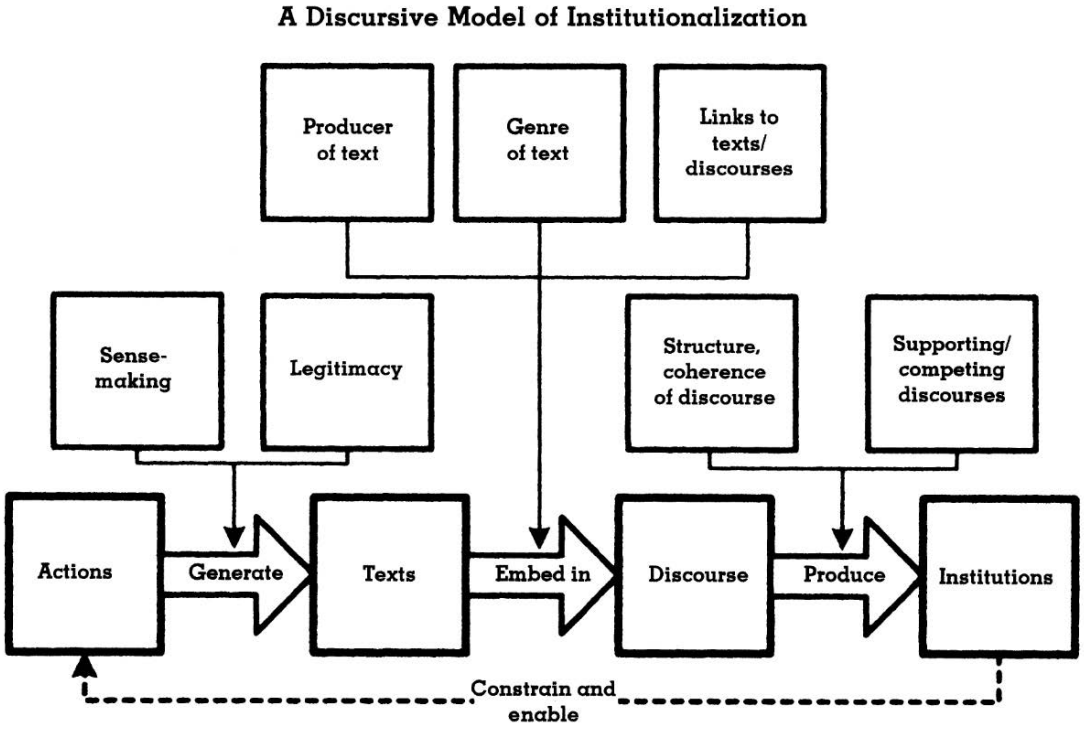

Figure 8: Graphic taken from *Discourse and Institutions* by Nelson Phillips, Thomas B. Lawrence, and Cynthia Hardy (2004). This image highlights the relationship among texts, discourse, institutions, and actions.

This research narrows the discourse frame to extract only the narrative aspects of values competing for legitimacy within those discourses. The discourse presents narratives and from those narratives' values can be extracted. From these values, researchers can model the institutional dynamics, or "actions" expressed within the institutional field. To extract the values from the discourses, this research borrows from the logic and methodology of Narrative Policy Framework.

Narrative Policy Framework

The logic of the Narrative Policy Framework (NPF), developed by McBeth, M., Jones, M. and Shanahan, E. (2014), is used to extract the competing values from the NCLB

policy narrative. The NPF framework emphasizes characters, plot, setting, and the central moral of the story to understand the policy narrative. NPF draws from five core assumptions: social construction, bounded relativism, generalizable structural elements, simultaneous operation at [multiple] levels, and a *homo narrans* model of the individual (McBeth et al., 2014). The logic of NPF is used as a device to isolate the value statements competing for institutional legitimacy.

When constructing the narrative, NPF directs us to the literary device of "hero" and "villain". This is a nominally objective stance rather than a direct value claim. This research does not seek either to legitimize or dispute the value claims extracted from the discourse. Rather it seeks to *identify* them. NPF suggests that the narrative format of a policy discussion, which this research extends into institutional discourse, utilizes the *literary devices* of heroes and villains as those pursuing a "good" value and those pursuing a "bad" value. The discourse narrative includes values statements, normative claims around what the institution should do/not do, what is good/bad, what problems should be solved, how, and by whom. In combination, discourse analysis, institutional theory, the narrative policy framework, and the propositions regarding value from Part One form the theoretical justification as well as inform the methodology guiding the choice of data and the methodology for collection.

Empirical space and evidence

This investigation focuses on the time period of 1998 to 2004. This time period spans the lead up to the adoption of the No Child Left Behind Act of 2001 through the period of its initial implementation.

Publicly available, existing documents have been collected and analyzed in the study. These secondary data sources represent the corpus used in this study. The documents published dates range from 1998 - 2004 and are restricted to newspaper articles due to their widespread readership.

This research identifies dominant public expressions of opinion on issues of concern regarding K-12 education within the period of NCLB's development and implementation. To avoid bias, individuals will not be interviewed. Following the logic of Phillips et al. (2004), written documents have a clearer and more lasting impact on the institutional field than individual acts.

The corpus is intended to capture the narrative by using broad search terms so that the boundaries of the field, as it is modeled, is inclusive of the public discourse within the scale it represents. Data gathering from each document captures the narrative elements of the author's message. The data collection table is developed following the Narrative Policy Framework (NPF) criteria for analysis and guided by the methods set forth in the field of digital humanities. In general, NPF elements include the characters, setting, and beliefs (McBeth et al., 2014). NPF draws from the work of Deborah Stone (2012) regarding the classification of heroes and villains in policy narratives. These narratives are collected and modeled using the computational tools of topic models and sentiment analysis.

Creating a dataset

First, a single dataset of competing values over time is constructed from available published material. To justify that the dataset represents the behavior of a changing institutional field, this research utilizes the logic and methodology of the discourse analysis method (Phillips et al., 2004). The assembled dataset identifies values placed in

competition for legitimacy in the institutional environment in public K-12 education from a period leading up to NCLB (1998 - 2002) to a period following its implementation (2002-2004). The timeline is tied to the reform movement that supported NCLB and the field level responses.

The goal of the data collection is to identify the institutional field of public K-12 education in the United States through the public narrative as captured in widely distributed newspapers. While the institutional field can be understood through many perspectives, the goal of this research was to cast a wide net in assembling the corpus. Five publications were used as the primary sources of newspaper articles that are publicly available and widely distributed across the United States: the *New York Times*, the *Chicago Tribune*, the *Los Angeles Time*, the *Washington Post*, and the *Wall Street Journal*. And all five publications are available in the US Major Dailies database within ProQuest.

Four search terms were used to filter the data: “education reform”, “k-12”, “public school”, and “public education”. Some initial searches within each publication were conducted in order to construct a list of “keywords” for exclusion in the search. For example, obituaries often include reference to the search terms, (i.e., public school) which is why they are included in the search results, but they include content that is either unrelated or only tangentially associated with the topic of interest. This resulted in the decision to exclude the term “obituary” from the article search.

Originally, the dataset was limited in size due to the time required to hand code articles. Using traditional hand coding techniques, the original corpus was limited to 300 articles. Incorporating information technology into the research design brought the

advantages of access to a larger more robust dataset. Employing machine learning technologies that can handle large data sets, the corpus (drawn from the same source) is 37,186 articles which turns out to be the entire body of articles from which the sample was originally drawn. And, with the advantage of machine learning, patterns in the data can be seen that were inaccessible before.

Field journal for purpose of analysis and replicability

To demonstrate intellectual integrity and lend additional credibility to the findings and explanations, the approach followed Patton's (2002) recommendation. This involved "keep[ing] track of and reporting alternative classification systems, themes, and explanations that were considered and 'tested' during the analysis" (p. 553). Field notes were taken to describe and record what was observed during the data collection process so that an accurate recall of the process is available. Special attention was given to any noteworthy observations that emerged from the data collection process. The reason for taking field notes follows from Patton's suggestion that "[f]ield notes contain the descriptive information that will permit you to return to an observation later during analysis, and, eventually, permit the reader of the study's findings to experience the activity observed through your report" (Patton, 2002, p. 313). In this way, the fieldworker can be described as a *process historian*. (see Patton, 2002).

During the data collection process, moments were taken to reflect upon the process and the content gathered thus far. As Patton (2002) describes, "[t]he observer, no longer caught up in adjustments to the newness of the field setting, begins to really see what is going on instead of just looking around" (p. 318). The data was reviewed often, looking for emergent patterns to discover areas of saturation and areas needing further

development. Again, this reflection and decision making is reflected in the field notes. Careful attention was paid to ensuring a reasonable representation of the breadth of data produced by the models. The closure of the data analysis was guided by what Glaser and Strauss (2017) describe as the instincts of the traditional field observer (see p. 224-225) in concluding a grounded theory study.

Capturing signals & creating a landscape:

Operationalizing the field through Humanities Analytics

This research employs the use of Humanities Analytics, a methodological approach that encompasses humanities research through information technology. Adopting computer science tools like machine learning to the task of social science generates a synthesis of disciplines and fruitful union to explore well-trodden topics in social science in a new light given the capabilities of machine learning (DiMaggio, 2015).

Humanities Analytics uses a large, digital dataset, digital algorithms, and scripts to detect patterns and signals that could not be seen without the computational power of digital technology. Humanities Analytics falls under the umbrella of artificial intelligence since it uses elements of machine learning and natural language processing. While the computer science nature of this discipline can be extremely complex, the beauty of this developing field is its accessibility to all research disciplines. One reason why Humanities Analytics is so accessible to non-computer scientists is because of its foundation in the coding language Python. Python is used to complete the processes necessary for the work, ranging from scraping data out of online databases to detecting patterns within the digital corpus, and from storing and transforming the data to visualizing the results.

Through Portland State University library, a 'seat' on the ProQuest TDM Studio platform was provided. This total data management platform, hosted by ProQuest, offers a comprehensive digital environment where researchers have access to the content of the ProQuest database and use of both pre-scripted visualization tools such as GIS, Topic Models, and Sentiment Analysis while also offering internal access to Jupyter Notebook, a coding environment that allows for creation and customization of digital 'modules' or 'packages'. ProQuest TDM studio and PSU's Computer Science department offered technical support and guidance in developing the models presented here.

Because Python is a widely used computer language and a large number of individuals are contributing to the Humanities Analytics toolbox, there is a vast and well vetted open-source library of tools to support this work. Not only are there already standard coding packages used by researchers, but a community of researchers contribute to updating code and sharing their knowledge in online forums and blogs. In sum, the researcher is not required to become a "Python coding expert" since the open-source libraries and pre-packaged code files can deliver the bulk of the coding work. It remains incumbent upon the researcher to have a basic level of proficiency in understanding the structure of the code and reading the code so that choices of parameters and structure of operations are understood.

In order to assess the appropriateness of the scripts chosen, the study follows best practices as described by published work in the field of Humanities Analytics (Gillani and Levy, 2019; Gonen, H., Jawahar, G., Seddah, D., & Goldberg, Y., 2021; Klein et al., 2013). Two separate methods within the field of natural language processing are used to model

the data: Topic Modeling and Sentiment Analysis. Topic Modeling is a statistical method to discover abstract concepts within a collection of documents. Sentiment Analysis is a computational method to determine the sentiment or emotional tone behind a series of words.

Both models used here employ unsupervised machine learning. An unsupervised topic model is described as "a machine learning process that is similar to clustering on numeric data, which finds some natural group of items (topics) even when we're not sure what we are looking for" (Kulshrestha, 2019, para. 1). Unsupervised topic models do not require labeled data for training and, instead, work directly with the raw texts. This produces a discovery of topics that would not be feasible to access via hand coding of the articles alone. The discovery of categories within the corpus can then be reviewed and labeled by the researcher. Specific to this research, topic groupings are used to identify the categories 'signals', 'actors' and 'values/classifiers'.

Latent Dirichlet Allocation (LDA) is one of the more common methods for performing topic modeling (Blei, 2011, Chuang, J., Manning, C. D., & Heer, J, 2012). LDA is a form of Natural Language Processing (NLP) - the process of turning text into data for analysis. "Latent Dirichlet allocation (LDA) is a generative probabilistic model of a corpus. The basic idea is that documents are represented as random mixtures over latent topics, where each topic is characterized by a distribution over words" (Blei, D. M., Ng, A. Y., & Jordan, M. I.., 2003, p. 996). Each document is represented as a mixture of topics, and each topic is represented as a distribution over words.

When LDA is applied to a collection of documents, two primary matrices are produced, a document-topic matrix and a topic word matrix. The document-topic matrix provides the topic distributions for each document in the corpus. Each row represents a document in the corpus and each column represents a topic. The value of a particular cell (i,j) in this matrix represents the proportion (or probability) of topic j in document i. The values in a row will sum up to 1 (or close to it, accounting for potential rounding errors) because they represent the distribution of topics within a single document. The actual interpretation of what each topic represents is based on the topic-word matrix where the researcher can see the most highly weighted words associated with each topic. In studies where humans evaluate two components of the latent space of a topic model: semantic coherence described as the quality of the topics inferred by the model and relevance of topic produced, the LDA model proved more interpretable than its comparisons. (Chang, J., Gerrish, S., Wang, C., Boyd-Graber, J., & Blei, D., 2009)

Connecting methods and theory to produce a landscape

As a review of Part One, Figure 9 from Holland (2012, p.57) simplifies the elements of a complex adaptive system that, for purposes of the methodology presented here, are most relevant to translate into the research of institutional fields. This chart presents some examples of systems, their agents, and the signals "that give rise to this flexible, changing behavior" (Holland, p. 57). In the context of institutional fields, *the system* is identified as the "institutional field", *the agents* are the people who hold the values that trigger the conversion of signal into behavior. And, *the signal*, which in this case, is information in narrative form. While people hold values, it is the value itself that changes within the field. Therefore, this is not a study of one individual, a group of individuals, or some form of

reducible, aggregate behavior. Instead, the values form an emergent element of the field itself.

Typical agents in a complex adaptive system

A complex adaptive system (*cas*) consists of a multitude of interacting components called *agents*:

System	Agents	Signals
Biological cell	organelles	signaling proteins
Immune system	antibodies	antigen fragments
Ecosystem	species	sounds, sights, smells
Market	buyers/sellers	buy/sell orders
Language	humans	sound sequences
Government	bureaus	memoranda
Internet	computers	messages

The agents are diverse rather than standardized, and both their behavior and their structure change as they interact.

Figure 9: Chart taken from *Signals and Boundaries* by John Holland (2012, p.57). This chart offers examples of systems, agents, and signals within complex adaptive systems.

Topics are elements of the field that are recognizable patterns of information. These "information gravity wells" or patterns that emerge from the data reveal what signals the field is directing its attention toward.

Breaking this methodology down to its utility is part of a normal science. Within that normal science, the field can be thought of a topology, a landscape, and as an agent with intention. The first step is learning what the landscape looks like, its physical composition. Topic modeling accomplishes this task by capturing the signals as patterns in time being processed by the field in terms of 'topics'. Next, the process moves from the

more objective stance to a more subjective understanding of the dynamics within the field. The researcher is tasked with assigning meaning to the topics by reviewing their content, considering their weight within the overall corpus, analyzing their change over time, and ultimately assigning chosen topics a label. These topics are the 'subjects' of the narrative or patterns of information holding the values.

If the signal itself is where attention is directed within the field, the next logical step is to ask, "To what end?" "What does the field 'want'?" "Are there areas where the field is especially turbulent, and in what ways?" These patterns can be further understood by learning the directionality of the terms, which can be determined by conducting a sentiment analysis or doing a close read of select articles and hand coding using the Narrative Value-Based Coding (NVBC) schema. This schema, presented for the first time within this research, will be further defined in Part Three. NVBC uses the concepts of values, actors, and their "wants" to provide indication of the disposition of certain terms. Hand coding using the NVBC and sentiment analysis gets at similar information. Hand coding offers more detailed, granular information than sentiment analysis, although sentiment analysis has the capacity to analyze large datasets indicating how specific terms are being expressed over time. These values or classifiers then provide the topology of the landscape as described previously.

This research uses topic modeling, sentiment analysis, and close reading of the text. While this research is limited in its scope, it is possible to extend and elaborate the exploration of topics by applying a variety of machine learning tools such as Nearest Neighbor and Word2Vec. The field is a vast space for exploration and the methods

presented here illustrate a small sample of what is possible within that exploration.

Topic model as a landscape

Topic models identify the signals being used by the field, which appear in the field as topics in the narrative. Visualizing the institutional field, then, must show those topics represented in a two-dimensional space. LDAvis is a script that uses the results of the LDA topic model to visualize those topics within a two-dimensional plane. LDAvis is interactive so that hovering over different topics or words changes the landscape to reflect the relationships of the topics to each other or the term selected. Appendix B has the files necessary to run this LDAvis interactive graph online. Figure 10 shows a still of the interactive landscape. Thinking back to the fitness landscape (Figure 5) image seen from the side in Part One, Figure 10 is a view of that landscape from the top looking down onto it. Specifically, this visualization is the result of the topic model showing 50 topics within the corpus that represents the national level public discourse, a sector of the field of American public K-12 education.

This visualization reflects the narratives of all 37,186 articles included in the corpus. Future research could build a more robust model of the institutional field creating a denser landscape of dynamic field interactions by comparing different sectors such as non-profit or for-profit narratives, academic journals, professional journals, or others. And each of these could be isolated by level such as state, region or school district.

Visualizing the field as a landscape of topics

LDAvis is a tool allowing the researcher to visualize the results produced using the LDA topic model. The LDAvis provides an interactive, global view of the topics over a two-dimensional space so that their proximity and relative scale are visually identifiable.

LDAvis also provides a display of topic weighted words allowing for deep inspection of the terms most highly associated with each individual topic. (Sievert & Shirley, 2014). Sievert and Shirley (2014) explain,

> [s]uch visualizations are challenging to create because of the high dimensionality of the fitted model - LDA is typically applied to many thousands of documents, which are modeled as mixtures of dozens (or hundreds) of topics, which themselves are modeled as distributions over thousands of terms. (p.63)

LDAvis makes the results of the LDA model more approachable (Blei et al., 2003; Griffiths and Steyvers, 2004).

LDAvis Visualization

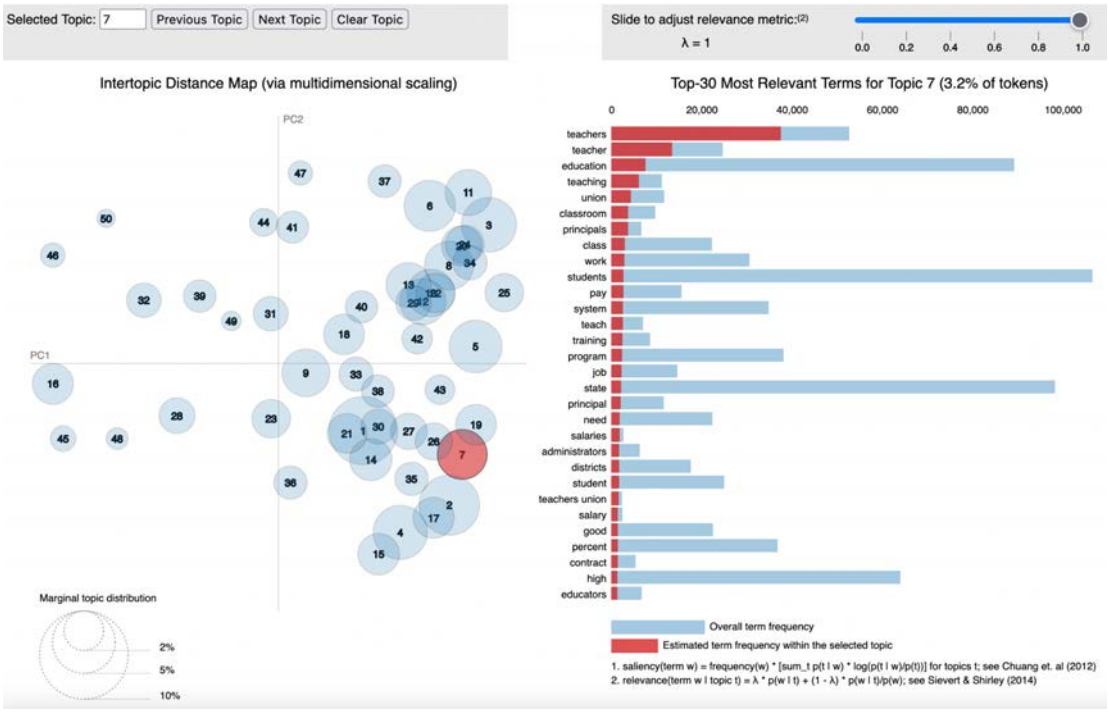

Figure 10: This is a screenshot of the animated LDAvis displaying the result of the topic model. The two-dimensional plane shows the 50 topics on the left with each circle representing a topic and the right side shows the top 30 most relevant terms for the topic selected, Topic 7 highlighted as a red circle on the left.

The LDAvis has two parts: a left panel where topics are visualized on a two-dimensional plane using intertopic distances and whose centers are determined by computing the distance between topics (see Figure 10). The areas of the circle represent the topic's overall prevalence; a right panel displays the topic's individual terms. The terms are interactive. When selecting a topic term, the display on the left changes to reflect its conditional distribution over the topics. Selecting a single term can then sort and reveal clustering patterns.

The visualization incorporates word relatedness whereby high-level patterns in the text surface (Chuang et al., 2012; Collins, C., Carpendale, S., & Penn, G., 2009; Hearst, 1995). Visualizing the topics in this two-dimensional space makes the topic analysis more accessible to viewers. Furthermore, the LDAvis demonstrates how topics form a landscape. Each topic occupies a particular location in relation to other topics and each topic holds part of the real estate in relation to the corpus as a whole.

The distribution of topics on the left panel gives the viewer an indication of how the topics relate to the corpus as well as how they relate to each other. Venturing one layer deeper into the topics themselves, viewers can also discover how the words relate to specific topics. Clicking a term in the right panel lights up the most highly related topics on the left panel. By default, the visualization displays the "Top-30 Most Relevant Terms" for the selected topic. These are the terms that are most highly weighted within the topic and are the terms the researcher will likely use to assign a label to the topic.

The visualization can also show terms based on their relevance to the topic itself. The slider bar on the top right panel adjusts a "relevance metric". Setting the relevance

scale to λ = 1 results in the familiar/default ranking of terms in decreasing order of their topic-specific probability, while λ = 0 ranks solely by their lift (Sievert & Shirley, 2014).

The relevance metric feature invites exploration of terms that, even if not probable terms in that topic, are particularly distinct in that topic. Looking at the right panel, the blue line shows the topic term in relation to the corpus as a whole and the red line reveals how much that term is distinct to this topic. Some terms are found only within this topic while other terms appear in this topic but are shared by many other topics in the corpus.

Mapping a term on the landscape

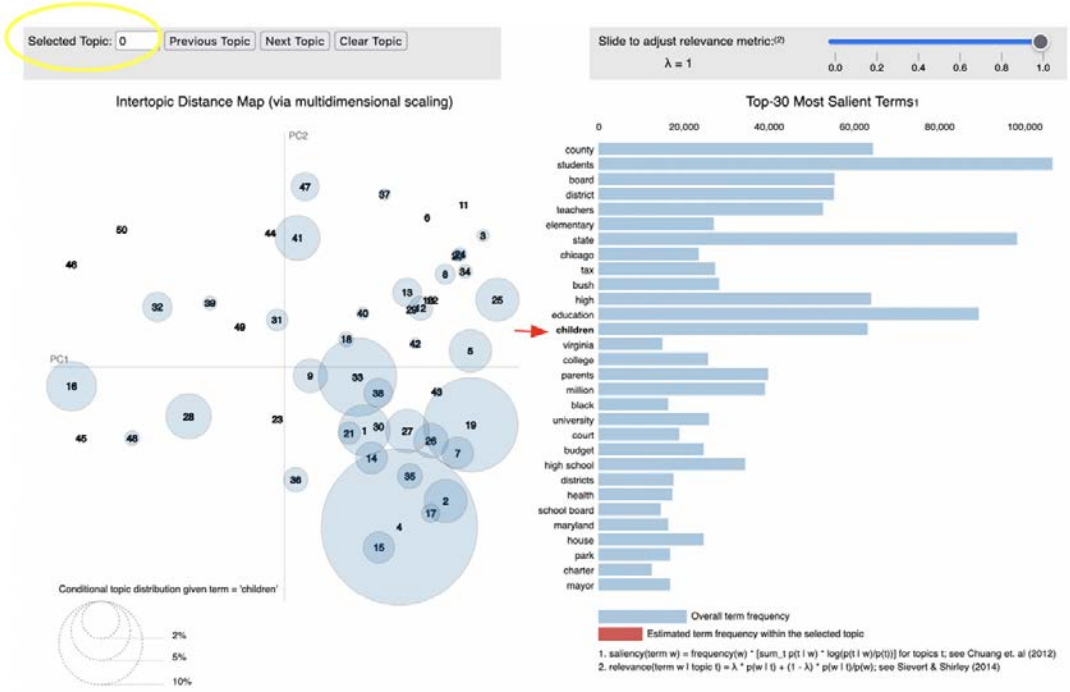

Figure 11: Screenshot of LDAvis showing the relationship of topics to the term 'children'. The list on the right shows the terms that are most relevant to the Topic 0. On the left panel, topics with larger circles are more relevant to the term 'children' than topics with small circles. Topics that have little or insignificant relevance to the term 'children' appear as numbers without the surrounding circle.

LDAvis allows the user to interact with the graph. Figure 11 shows an example of how the user can scroll over a word associated with one of the topics and see its relationship to other topics. Figure 11 shows the term 'children' and its conditional distribution across all topics. The size of the topic circle enlarges or shrinks based on how much the word 'children' is weighted within that topic. This grouping of topics represented by the relatively larger circles on the left panel of Figure 11 can be interpreted broadly as a discussion of 'children'.

In Topic 0 (the topic selected in the top left corner of the screen in Figure 11), the term 'children' is the 13th most heavily weighted term within that topic. It can be observed from the graph that the term 'children' is most highly associated with topics sharing the same quadrant. The clustering of topics within the same two-dimensional region that all discuss, to varying degrees, the term 'children', verifies, to some extent, their multidimensional scaling (Sievert and Shirley, 2014). The handful of topics that are more sparsely distributed suggest that 'children' is a term mentioned in a variety of topics. However, due to the distance from the larger cluster of related 'children' related topics, it can be assumed that there is a significantly different semantic context to those topics in regions far from the clustered topics that are, in comparison, in high proximity to each other.

A topic's location on the two-dimensional plane tells the viewer about the topic's relationship to other topics. Figure 12 highlights Topic 7. Viewers can see that Topic 7 is most closely related to Topics 2, 19, and 26 because the topic circles touch or overlap. Topic 26 also connects to Topic 27, indicating that there is some chain of narrative

Learning About Topics Based on Location

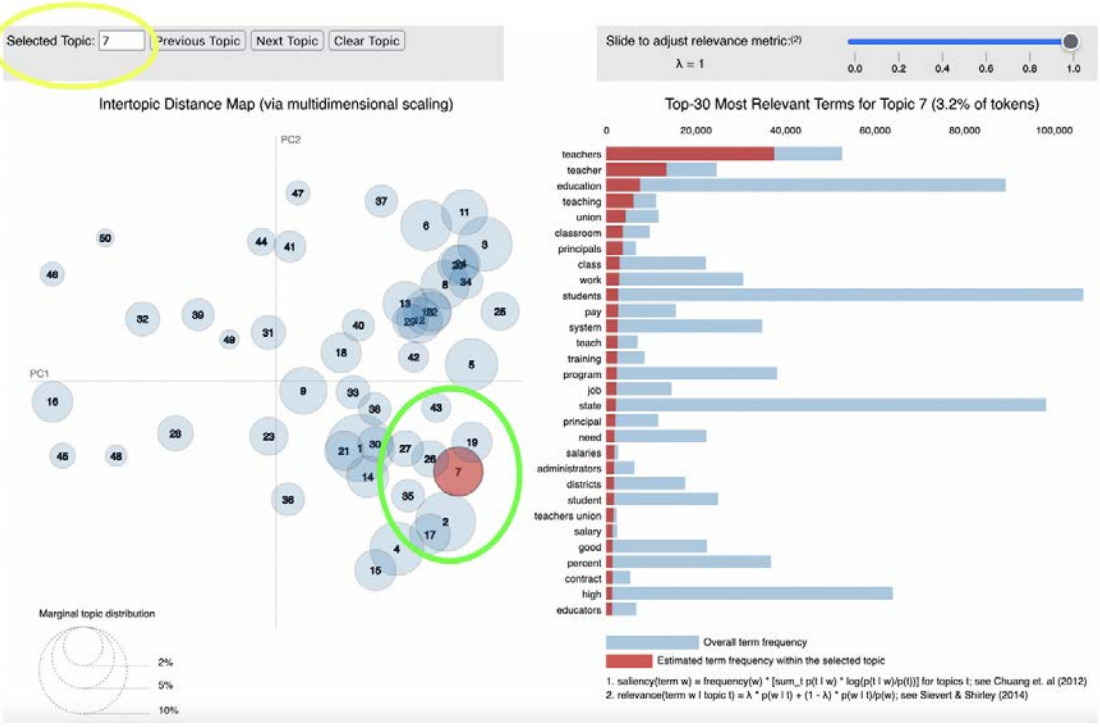

Figure 12: Screenshot of LDAvis showing topic 7's location in relation to neighboring topics.

connecting those topics. If a researcher wanted to conduct some exploratory data analysis of Topic 7, Topic 7's location within the two-dimensional space would provide clues regarding its content in relation to other topics.

Topic 16 circles in green (Figure 13) is an example of a topic that is located in a fairly isolated region of the two-dimensional space. Topic 16 also has a relatively low weight within the corpus as a whole, as shown by the size of the topic circle. The Marginal Topic Distribution key in the bottom left of the graphic can be used to judge the relative weight of the topic within the corpus. Topic 16's circle indicates that approximately 2% of the total number of words across all documents in the corpus are attributed to this topic.

Topic in Less Densely Occupied Space

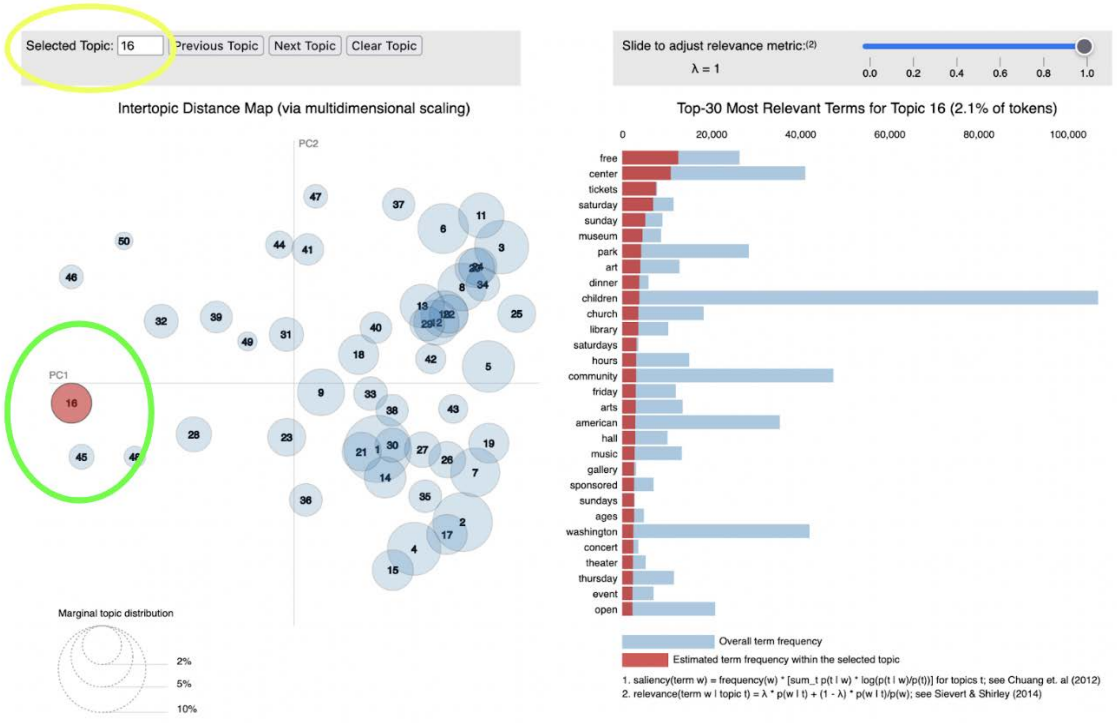

Figure 13: Screenshot of LDAvis for Topic 16. Topic 16's location on the far-left side of the graph indicates that the content of this topic is not very similar to the other topics in terms of its word composition or content. The size of the circle shows the marginal topic distribution at 2%.

Topic 48, circled in green, in Figure 14 is a good example of a topic with a low marginal topic distribution and little saliency, meaning that it does not contribute very much to the overall corpus shown by its small circle area. The content is distinctive in that its content is not highly shared by other topics, which users can observe by its relatively isolated location. A quick glance at the top 30 most relevant terms for Topic 48, the observer can infer that the narrative content of this topic centers on 'school lunch.' Users can gather more insight into this topic by adjusting the relevance metric (Figure 14) which resorts the words to show the terms with the most 'lift.' The term 'milk', third term from the top, is used almost exclusively in this topic.

Fairly Isolated Topic Occupying Little Space

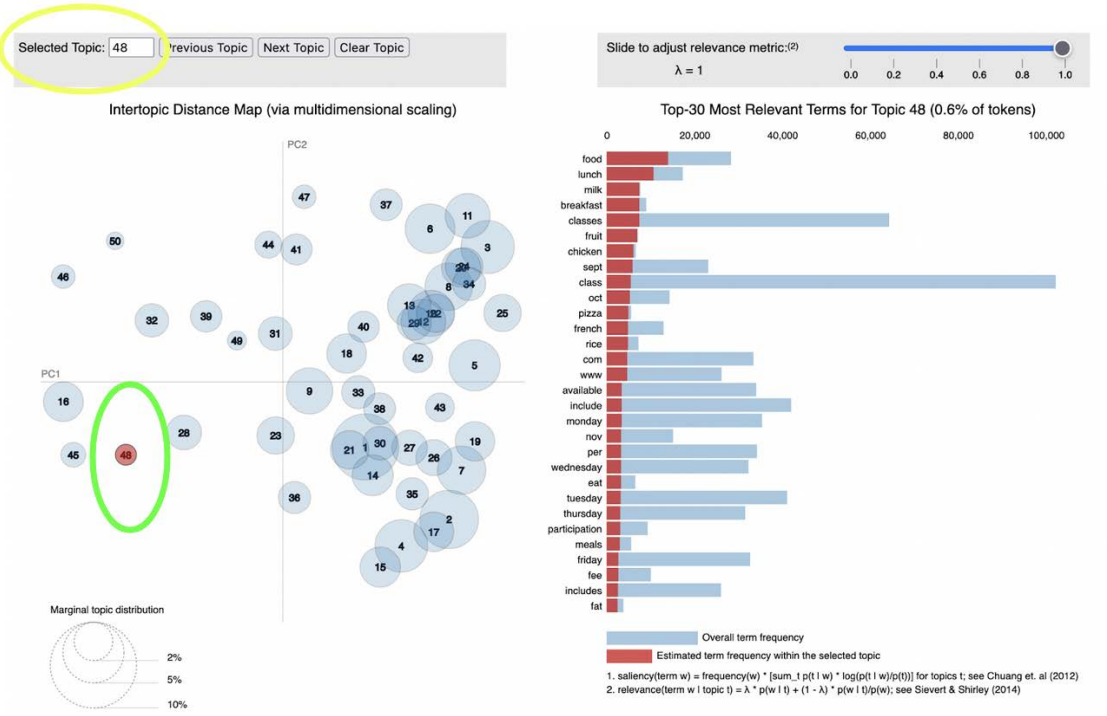

Figure 14: Screenshot of LDAvis for Topic 48. This Topic has a low marginal topic weight and distinct content compared to other topics.

Each of these interactive stills describes features of the landscape. The next two examples offer insight into how the interactivity reveals connections between the landscape and the narratives the topics include. Selecting a single term can then sort and reveal clustering patterns. Figure 15 and Figure 16 both feature Topic 7. These two graphics show, by comparison, what happens when a single term is selected from the panel on the right. The right side of the two-dimensional plane lights up when the term 'good' is selected (Figure 15). Hovering over the term 'students' shows a narrower selection of topics located in the bottom right quadrant (Figure 16). Therefore, 'good' is a more distributed term throughout the corpus while 'students' is more specific to a select group

Term ‘good’ in the Landscape

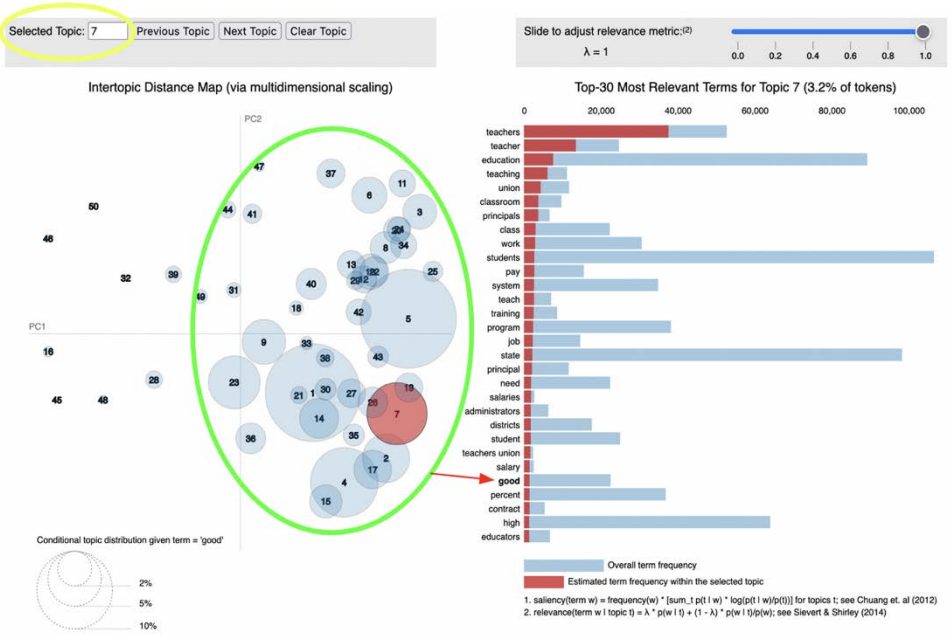

Figure 15: Screenshot of LDAvis for Topic 7 showing the topics related to the term ‘good’.

Term ‘students’ in the Landscape

Figure 16: Screenshot of LDAvis for Topic 7 showing the topics related to the term ‘students’. of topics. Viewing the interaction of the two topics, users can see that ‘good’ and ‘student’ have a relationship in the topic space and, therefore, in the narrative content.

Interacting with the animated visualization brings details of the landscape into view and the animation itself exposes an outline of a story, or at least places for the investigator to continue to explore based on the relationships they revealed. Figure 17 is an attempt to demonstrate how the animated interaction can lead to further insights or interest in areas that pique the investigator's curiosity.

The storyline in Figure 17 begins by exploring Topic 7 by reducing the relevance metric to 0. Now, the words appearing in the right panel have resorted themselves so that the most relevant terms to this topic appear. Panel one of Figure 16 shows the terms most related to the topic 'class size'. Topic 7 circle is indicated in red and its size increased to show that Topic 7 is very highly related to the term 'class size'. Next, the list of terms on the right panel was reviewed and the term 'reduce class' was chosen since it might reveal more information about the narrative of 'class size'. Panel two in Figure 17 shows the topics most associated with the term 'reduce class'.

A Storyline of Landscape Exploration

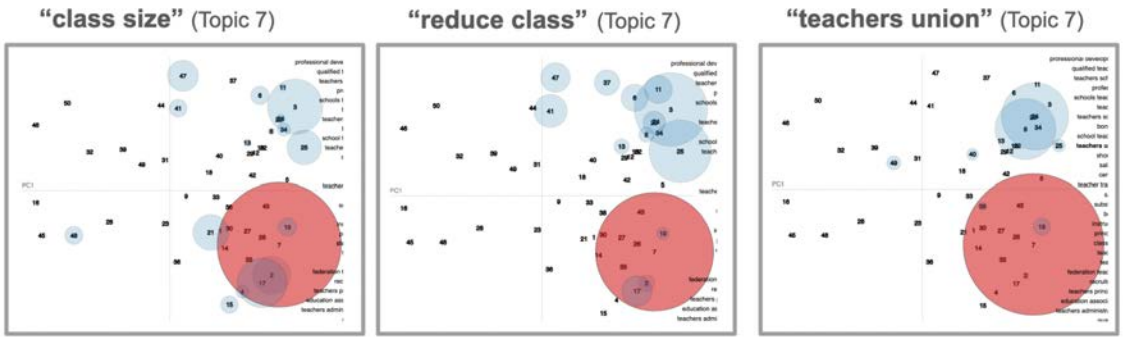

Figure 17: Screenshots of LDAvis for Topic 7. Each panel shows a still of the animated visualization and display the most highly related topics for the terms listed above each of the panels.

Comparing panel one and two shows small differences. For example, Topic 21 (found on the left side of the Topic 7 red circle) is not a part of the ‘reduce class’ narrative, while Topic 47 (found in the top center of the quadrants) holds the ‘reduce class’ narrative but not the ‘class size’ narrative.

Finally, a decision was made to undertake a more creative exploration of the topic. Drawing on professional knowledge and experience working in public schools, it was recognized that 'class size' and 'reduce class' were key issues that unions often strive to improve. Upon reviewing the terms in the right panel, the term 'teachers union' was selected to discover what other topics are related to it. Topic 7 is highly related to all three terms chosen in this storyline and the topics in the top right quadrant hold narratives specifically addressing ‘teachers union’. Exploring the data in this way offers researchers a guide to how the narrative connects, a path to follow through those connections, and indications of where there are curious relationships between topics or terms to further explore.

Placing the landscape in time

The institutional field shown through the LDAvis animation is fundamentally a static view of the LDA model results. However, the institutional field is a dynamic landscape defined by the values competing for legitimacy. Displaying each topic over time shows this dynamic interaction. The LDA topic model was designed to output a graph for each topic displaying the topics change in the discourse over time. Figure 18 shows the graphs of 4 different topic models: Topic 26 top-left, Topic 9 bottom-left, Topic 24 top-right, and Topic 18 bottom-right.

It should be noted that the numbers assigned to the topic are a product of the model's output and do not hold meaning beyond simple identification of the topic. In addition, the topic number titles provided in the LDA outputs do not match the topic number titles used in the LDAvis visualization. An LDA topic can be found in the LDAvis visualization by matching the content of the topic to the words associated with the topic. Then, the topics can be renamed by the researcher so there is consistency across the representations.

Each graph in Figure 18 displays a list of words across the top of the graph. These are the top 10 most heavily weighted words within that topic. The x-axis shows the time range of the corpus starting on January 1,1998 and ending on December 31,2004. The y-axis represents the normalized weight of a topic within the corpus. The normalized weight of the topic is calculated as the ratio of the weight of the topic to the sum of the weights of all topics at a particular time. These topic graphs display data points for each quarter. This metric ensures that the sum of the normalized weights of all topics is equal to 1 at each time point. This provides a measure that is comparable across different time points despite potential variations in the overall volume or intensity of discourse. For example, a y-value of .040 (or 4%) for a topic at a specific time point indicates that the weight of that topic constitutes 4% of the sum of the weights of all topics at that time.

Using these graphs, users can see these topics change in the discourse over time. If the y-axis of a graph goes up for a particular topic, that topic is becoming more dominant in the conversation as time goes on. If the y-axis goes down, the topic is being talked about less compared to other subjects. Essentially, the y-axis tells us how much attention each

topic is getting in the conversation over time.

The document metadata is attached to all words, topics, and dates. Therefore, a researcher can track back to any of the articles represented at a given point on the graph. Figure 18 highlights a spike in the data and the articles associated with that time period can be retrieved for further analysis. Additionally, because the metadata for each data point is preserved, the most heavily weighted articles for each topic can be retrieved.

Topics over Time

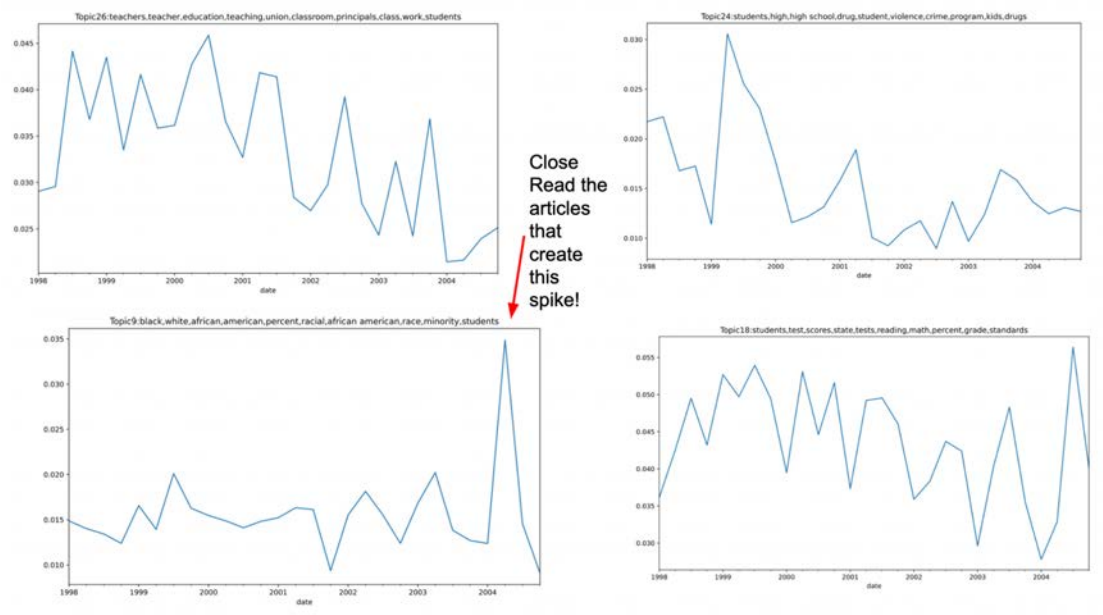

Figure 18: A graphic display of 4 topic graphs over time. Each datapoint holds metadata for the narratives that represent the datapoint including the newspaper article citation data. The y-axis represents the normalized weight of the topic within the corpus and the x-axis represents the time ranging from Jan. 1, 1998 to Dec. 31, 2004. These are topic model graphs. Each graph represents a cluster of words.

Each graph in Figure 18 is showing a story over time. Signals are the information being processed by the field, defining its boundary. Signals with no associated value are not processed within the field and not part of the field. Signals with positive sentiment

push down to form valleys representing legitimacy and those with negative sentiment push up to form barriers. Wherever a signal can be identified through topic modeling, the associated values are generating the inclusion of the topic in the field and so are defining the landscape. Defining the field is the topic and the value embedded in that topic shapes the topography of the field. Looking at Figure 18, an expert who experienced events of the time period shown, or who knows the history of this empirical space, can likely fill in the narrative explaining these changes in the graph.

A Story in Time

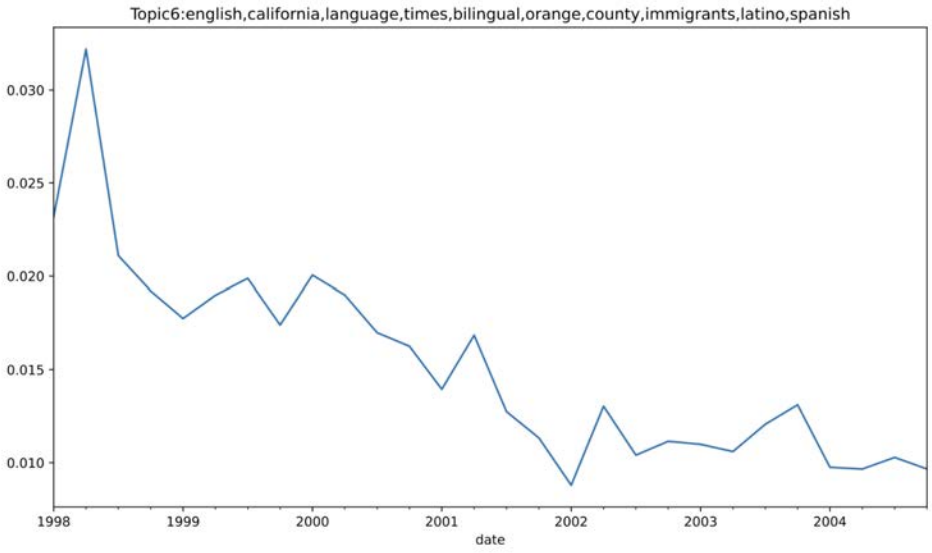

Figure 19: Topic model graph showing topic 6. The top 10 most heavily weighted words for topic 6 are displayed across the top. The y-axis shows the normalized sum probability of the topic within the corpus. The x-axis includes the period of time represented by the corpus.

Sentiment Analysis

If values are classifier rules that convert signal to behavior, and if using topic models and NVBC can help us discover which signals are being converted, this is still only half the puzzle. Next, researchers need to know the directionality of values within the field

in order to know what the field is disposed to do with the signal. Knowing the signals being processed and the disposition of the field toward converting those signals to action provides the necessary information to those seeking to model the field. It is one thing to *have* a value, it is another thing to know how to *act* due to the rules embedded within that value.

Since this research and methodology is grounded within the paradigm of complexity, the goal is to capture system states and patterns in time as opposed to treating the social phenomena as a linearized machine with parts that can be isolated and tested for causal relationships. No single input or even pairs or triads of inputs determine specific outcomes within a complexity paradigm. Instead, a nonlinear, twisted arrangement of the whole system produces the system state at any given moment. As Dave Snowden puts it, if we want to affect a system toward a goal, we must know what the system is *disposed* to do (Snowden, 2015) and nudge it according to what it *can* do in the direction we want it to go.

This research is explicitly designed to reveal facets of what an institutional field is disposed to do at any given time. With the advancement of Humanities Analytics, researchers can see the system as a series of system states and a collection of patterns over time. From this, it can then be determined what the system is disposed to do and leaders can act accordingly based on the goals for the system's direction.

Sentiment as directionality

In order to investigate the value's rules and disposition, this researcher employs sentiment analysis to identify the areas of turbulence where those values are competing within the field. Once the areas of turbulence have been identified, researchers can drill

down into the data for those specific events by retrieving the documents and doing a close read of the articles to capture the narrative details of the contentious value.

Graphing a term's sentiment over time allows researchers to see *if* values are competing for legitimacy, or, in visual terms, crisscrossing over each other in a competition for legitimacy. Following up with a close read of the text provides greater insight into how and why the value is being infused within the institutional field.

It is important to note that sentiment analysis does not actually tell us anything about what the content of the landscape is. Rather it tells us that positive or negative value is being attached to terms that were previously identified through topic modeling or other means. It is left to the researcher to guide the process starting with the choice of terms to analyze to the interpretation of patterns in the model results. The sentiment analysis graph over time alerts the researcher to unusual patterns as candidates for drilling down. A close inspection of the narrative discovered through sentiment analysis, especially taking notice of the value-laden narrative elements using NVBC schema offers a clearer vision of what the field is disposed to do. The field's particular disposition regarding certain rules/classifiers provides a level of predictive capacity for decision makers when they attempt to affect change within the field. Part Four will elaborate on these lessons for leadership.

Just like topic modeling, the method of sentiment analysis adds to the toolbox for research on social systems as complex adaptive systems. While sentiment analysis differs from topic modeling in that it is not a statistical method but rather a computational method, it offers a level of computational ability that is beyond what a single human or group of

humans can reasonably provide alone. Sentiment analysis is not as precise as topic models due to the fact that it relies on either predefined lexicons or training on fairly narrow semantic sets so that predictions of unknown, yet similar, texts can be made. For the purposes here, sentiment analysis is a tool to discover where in the narrative there is stability and where there is contention. Specifically, it is used to capture the dynamic expression of the signals and classifiers.

For example, if the institutional field of education holds a value that is generally accepted as positive such as school maintenance and cleaning being conducted on a regular basis, then when (and if) school janitors/custodians are mentioned in the narrative, we would expect to see a stable favorable mention of those terms. If the value of having paid professionals clean and maintain school buildings were to shift in the institutional values and go from stable to contentious, we would see that change in the sentiment analysis data. We would also expect a topic model to identify that subject as a relevant signal. Whatever value introduced into the system that competed with the formerly stable value of "janitors/custodians as positive" could be identified, named, and understood as the value or values now competing for legitimacy.

The sentiment analysis model used in this research is a tool called VADER (Valence Aware Dictionary and sEntiment Reasoner) (Hutto and Gilbert, 2014). VADER is a package offered through 'nltk' (Natural Language Toolkit), the popular Python library for working with human language data or text. (See Appendix A for file of the script). VADER has a predefined list of words, each assigned a polarity score. This score indicates whether a word has a positive, negative, or neutral score and to what degree. The model

not only considers individual word polarity but it understands elements of the context and modifiers that can intensify or diminish sentiment.

The parameters are set so that individual sentences are evaluated and results are based on the individual sentence scores rather than at the level of the document. Individual document scores can be gathered. However, the aim of this method is to provide understanding of the directionality of certain words or entities in context of the field. This level of granularity is best defined at the level of the specific sentence where the mention of the word or entity is placed rather than at the aggregated sum of the document's overall sentiment. Having access to the individual sentences gives the researcher the ability to conduct a focused close read and then broaden their view to include the article/document overarching content - offering more content to the sentiment itself.

Sentiment analysis indicates, in a general way, what the agents are processing as a classifier or rule as well as the potential directionality of that classifier on a scale of positive, negative or neutral expression. The model allows us to visualize the degree of the sentiment and its change over time. To develop a detailed picture, further investigation into the specific sentences used in the indicated segment of the sentiment graph is needed. Figure 20 offers an example of this below.

Sentiment analysis models aid us in learning and visualizing the sentiment of something as it appears across a large corpus. There are a number of ways that sentiment can be aggregated and displayed. For the purposes here, sentiment is gathered at the sentence level, retaining its metadata information so that articles can be read as a collection of these identified sentiments.

The VADER model, as mentioned earlier, is able to assess the positive, negative, or neutral sentiment and to what degree. The scale for positive or negative sentiment is from 0-1 shown in decimals. Neutral is set to binary with the value of 1 or 0. This analysis uses the labels 'pos_flag' or 'neg_flag'. Those labels display the absolute value of the sentiment so that a positive sentiment of .02 would translate as a value of pos_flag equal to 1. The absolute value is useful in determining the magnitude of the word being used within the discourse since each pos_flag or neg_flag is equivalent to a sentence having a positive, negative (or both) mention of the word. Neutral mentions of the word were not analyzed.

Sentiment Analysis Graph of 'education system' and 'system of education'

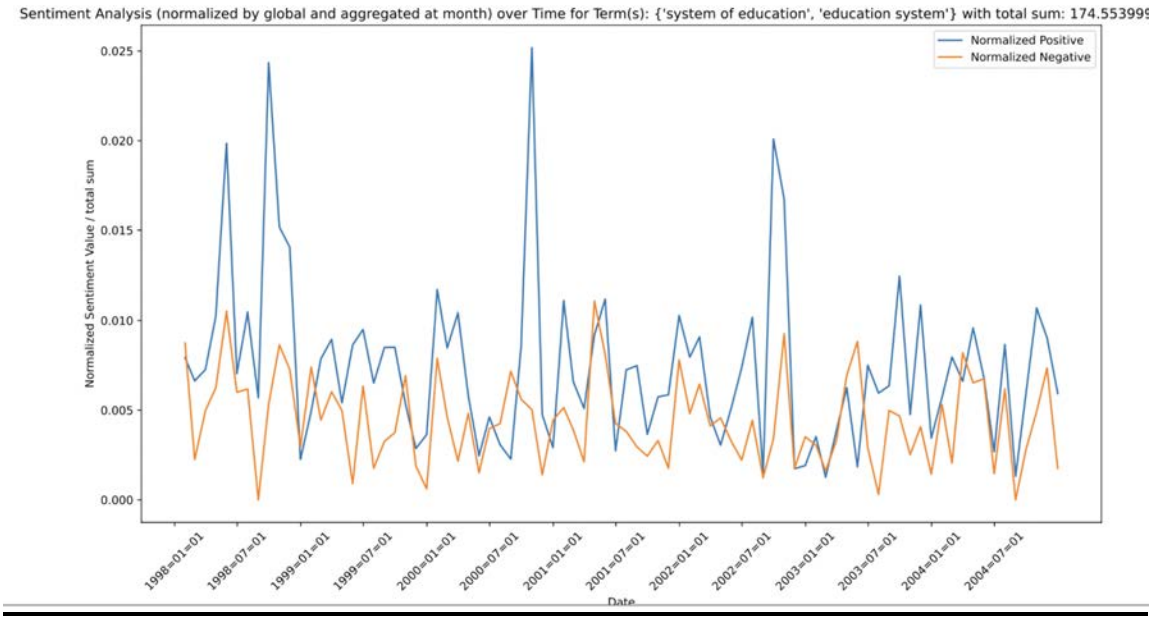

Figure 20: Sentiment analysis graph of terms 'system of education', 'education system'. The y-axis displays the normalized sentiment value and the x-axis displays the time ranging from Jan. 1, 1998 to Dec. 31, 2004. The blue line is the positive sentiment and the orange line is the negative sentiment.

The graph in Figure 20 shows the sentiment analysis value for 'system of education' and 'education system' changing over time. The sentiment values were aggregated by month for each the positive sentiment and, separately, the negative sentiment. These values were normalized over the sum of all values both positive and negative. In Figure 20, this is listed as 'normalized by global' and shown on the y-axis. The 'total sum' listed in the title of the graph represents the number of sentences with a positive or negative mention of the term. Figure 20 shows an example of the sentiment analysis graph used in this analysis. The researcher selects a term for analysis and then the model filters through all sentences to locate the sentences holding the identified term. In this model, sentiment is then determined at the sentence level, as opposed to the document or corpus level.

Figure 20 shows a typical trend line where positive sentiment and negative sentiment run fairly in sync to each other. Positive sentiment, in general, tends to trend higher than negative sentiment. To give the viewer a sense of the 'intensity' of the sentiment, let us focus on the positive sentiment spikes that reach a y-axis value of 0.025 around July 1998 and July of 2000. This value can be translated to read that the negative sentiment for each of these spikes accounts for 2.5% of the total sentiment of 'education system' or 'system of education', both positive and negative, expressed over the entire dataset. The areas on the graph where positive and negative sentiment compete are the areas where attention can be given to the changing dynamics of the field.

Table 2 is an example of a sentiment analysis output used here to illustrate some of the data the model produces. This example shows that the document's information (listed as the 'goid' or unique article identifier) is preserved for each datapoint. The 'goid' can be

Sample of Results Showing Number of Sentiments per Article

goid	total_pos_flag	date
409619410	6	2004-04-04
432888102	5	2004-10-14
432771180	4	2004-05-12
408657313	3	2000-07-11
419548369	3	2001-12-26
...	...	...
421780313	0	2003-04-26
408617672	0	2000-04-11
408622970	0	2000-05-28
421224907	0	1998-03-08
418785396	0	1999-04-26

[981 rows x 3 columns]

Table 2: Screenshot taken of some of the results of the sentiment analysis script.

used to pull up the metadata of each article and therefore all sentiment scores can be traced back to their source within the article itself. The Positive value and Negative value are the scores the model assigned to the sentiment. Scores range from 0 to 1 with 0 indicating no sentiment and 1 indicating high sentiment. The Pos_flag and the Neg_flag represent the absolute value of the sentence sentiment. If both Pos_flag and Neg_flag hold the value 0, then the sentence is considered neutral. Table 2 shows the total_pos_flag for the terms 'education system' and 'system of education'. The parentheses at the bottom of the table indicate that there are 981 articles associated with this searched term.

Because the TDM Studio platform imposes copyright restrictions limiting export on some forms of data from the TDM Studio platform, this research will not be able to include ample evidence of the sentiment values given to specific sentences. Figures 21 – 25 show the first 5 entries from a random sample of individual sentence results for the

sentiment analysis of the term ‘education system’ or ‘system of education’. For these select few examples, the articles were downloaded so that the article information accompanies each entry. The articles containing the sentences used in the examples have been referenced in the bibliography.

Sentence Example : Neutral Sentiment

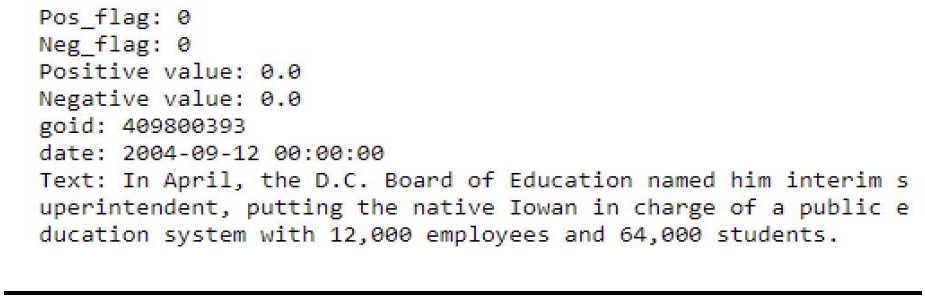

Figure 21: This is a screenshot taken from the results of the sentiment analysis script for the terms ‘education system’ and ‘system of education’. This sentence was evaluated by the model as holding neutral sentiment. The citation for the article can be found in the reference list under Sewell, 2004.

There was no positive or negative sentiment detected in this sentence (Figure 21). The sentence is simply reporting on who is the interim superintendent. The neutral value seems appropriately assigned here.

Sentence Example: Negative Sentiment

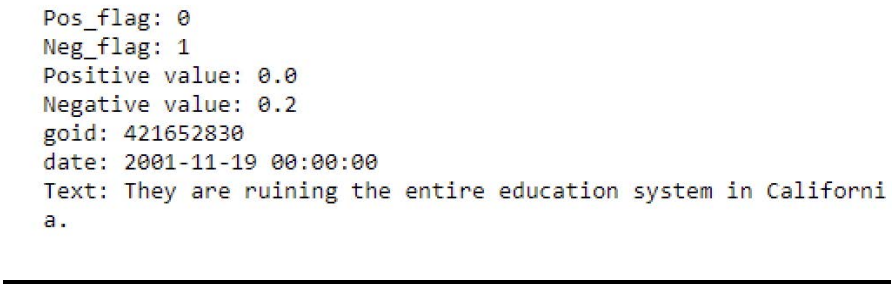

Figure 22: This is a screenshot taken from the results of the sentiment analysis script for the terms ‘education system’ and ‘system of education’. This sentence was evaluated by the model as holding a negative sentiment value of 0.2. The citation for the article can be found in the reference list under UC Admissions, 2001.

Figure 22 provides an example of a sentence that was assigned a negative sentiment value. While there's agreement that the sentence is labeled correctly, the value of negative sentiment (with the highest negative sentiment valued at 1) appears rather low, especially considering the strong word 'ruining' and its attribution to the 'entire education system. The relatively low negative value score may be due to the brevity of the sentence content, but that is simply conjecture.

Sentence Example: Positive Sentiment

```
Pos_flag: 1
Neg_flag: 0
Positive value: 0.372
Negative value: 0.0
goid: 432580524
date: 2003-11-06 00:00:00
Text: Quite frankly, the better the education system, the bette
r the town, the better the property values,'' Mr. Scarborough s
aid.
```

Figure 23: This is a screenshot taken from the results of the sentiment analysis script for the terms ‘education system’ and ‘system of education’. This sentence was evaluated by the model as holding a positive sentiment value of 0.372. The citation for the article can be found in the reference list under Selingo, 2003.

This is an interesting example because ‘better’ can hold a negative sentiment or positive sentiment depending on how it is used. For example, “I wish we had a better education system” holds a negative sentiment while “I think you have better teachers this year” would indicate positive sentiment. Therefore, it is good to see that the model picked up on the positive use of the word ‘better’, but the value seems a bit high. The multiple uses of the word ‘better’ may have amplified the value.

Sentence Example: Positive and Negative Sentiment

```
Pos_flag: 1
Neg_flag: 1
Positive value: 0.057
Negative value: 0.062
goid: 398757803
date: 1999-11-03 00:00:00
Text: And an Intel spokesman says that "even though Intel's top
priority on the state level is developing a world-class educati
on system, we are not sure that more taxes are the answer."
```

Figure 24: This is a screenshot taken from the results of the sentiment analysis script for the terms 'education system' and 'system of education'. This sentence was evaluated by the model as holding a negative sentiment value of 0.057 and a positive sentiment value of 0.062. The citation for the article can be found in the reference list under Eure, 1999.

In the Figure 24 example, Intel is stating their priority to develop a world-class education system, a positive sentiment, and they are not sure taxes are the answer. Not having an answer may be why the sentiment was valued as negative .062. It is unclear to me what in this sentence holds negative sentiment. And, the word "more" probably amplified the sentiment value assigned to that section of the text.

Sentence Example: Questionable Positive Sentiment

```
Pos_flag: 1
Neg_flag: 0
Positive value: 0.112
Negative value: 0.0
goid: 409667127
date: 2004-04-20 00:00:00
Text: "The District's public education system is broken," Willi
ams said, addressing a midday rally attended by a few dozen sup
porters in front of the Wilson government building.
```

Figure 25: This is a screenshot taken from the results of the sentiment analysis script for the terms 'education system' and 'system of education'. This sentence was evaluated by the model as holding a positive sentiment value of 0.372. The citation for the article can be found in the reference list under Blum 2004.

Figure 25 is an example of a sentence with the value assigned to the sentiment that seems questionable. Because the VADER sentiment analysis model is not trained on text that is content specific, rather it uses a lexicon to assign sentiment values, some results could be improved for accuracy. Figure 25 is an example of one of those questionable results.

This last example (Figure 25) is included because it illustrates that mistakes can happen. The statement "the district's public education system is broken" should have gained some negative sentiment value, but it didn't. It is unclear why the negative sentiment value is 0. Perhaps the quotes threw the score off or words like 'rally' and 'supporter' gave the impression that this was a positive statement in general. This research will not investigate this issue further.

In cases such as these, the researcher can read the article and in doing so they may find that the article has a generally positive tone. The next sentence in the article may be, "And we are all here to fix it!" A close read would allow the researcher to see those details. But for now, these sentiments allow the researcher to look for dynamics in the field. It is always the researcher's responsibility to turn to the actual content to find the full meaning of what these models produce.

Part Three: Case Study – The institutional field of public K-12 education in the United States from 1998 – 2004

Data transformation grounded in the propositions

This section integrates the adaptive institutional topology theory (AITT) from Part One with the methods outlined in Part Two. The combined approach is applied to the case study of the institutional field of public K-12 education. This application aims to understand and visualize this field as a complex adaptive system.

Institutions emerge from our collective imaginations. They become "regions of stability" by holding values which in turn direct the purposeful action of the institutional field. Therefore, the initial step in visualizing the institutional field is to reveal the values it holds. Hierarchically, the institutional field exists at the highest level of institutional organization. This research explores an aspect of this level. And, since an institutional field cannot be separated into parts that can be recombined to predict the outcomes of choices, the values that are captured within this study represent those values that are within the corpus alone. In other words, the results of this study will only show the institutional field at a low resolution.

In order to increase the resolution, the researcher would need to analyze multiple corpuses and compare the results of each corpus against the other. Each corpus represents a subset of the overall narrative. The corpus chosen for this study is intended to capture the broad, public narrative found in newspapers. It is a starting point in modeling the institutional field, but it is not complete.

Other sources of narrative or separate corpuses could be drawn from academic journals, policy documents, public testimony and statements, meeting minutes and

transcripts, reporting documents such as IRS Form 990 or documents generated during the grant proposal and management process, professional publications, social media, or other field specific bodies of text. The values embedded in alternate corpuses each illuminate different facets of the overall institutional field as a landscape of values competing for legitimacy. And each of these separate narratives may hold unique or specific influence on the institutional field as mechanisms of coercion or isomorphism yielding greater influence on the field behavior than other signals entering the field.

This research presents a two-dimensional visual representation of the signals and values discovered, and their change over time. While topic models help catalog the values as they emerge in the field, sentiment analysis helps pinpoint contested values and tracks their change in intensity over time. When value A holds a positive sentiment over a period of time but then shifts to majority negative sentiment at some point, the field is undergoing change. This movement in sentiment is a place to drill down into the documents to manually identify what is happening in the field dynamics, to discover the levers that facilitated or triggered the sentiment shift, and to investigate what the shift in sentiment means to the institutional field overall.

Values inform behavior. And, when values shift, it can be assumed that behaviors change as well. Again, these models do not tell the researcher the answers; they simply point the researcher to potentially fruitful and important areas to ask more questions, to discover, to look for the values that are changing and the nature of the change. In the end, the institutional field does not follow deterministic rules. The institutional field is a complex adaptive system. Therefore, in order for this research to be effective in producing

results that the researcher finds useful, the researcher using this methodology must use these tools and adhere to the rules and assumptions of the paradigm from which these methods originate - the paradigm of complexity embracing persistence as the quality of being.

This section uses the research process outlined in Part Two. First, topics within the public discourse are identified using an LDA topic model. Next, the hand coding process developed according to the logic of NPF named Narrative Value-Based Coding (NVBC)[2] is applied. This coding schema involves a detailed examination of selected articles to identify actors and their associated values. Returning to the corpus as a whole, sentiment analysis is conducted on terms that were generated and collected from the previous two steps.

The sentiment analysis graphs reveal value trends over time including directionality. At this stage, the topology of the institutional field begins to appear with the positive sentiment signals either reinforcing the existing valleys or planting the field with newly introduced values. The negative sentiment signals create hills that act as barriers. Or, the negative signals push up on the existing positive sentiment valleys - ultimately leaving the landscape with a shallower positive valley or, if a strong enough destabilizing force is applied, changing the face of those basins of attraction all together. Part Four offers a more detailed description of how the regions where values are competing for legitimacy can be conceptualized and used to guide decisions for leadership.

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[2] Narrative Value-Based Coding (NVBC), introduced here for the first time, is a coding schema designed to identify values and their associated sentiments within textual data.

In addition, the LDAvis interactive visualization is used to illustrate interrelationships between topics through the individual topic's relevance to other topics, as well as the corpus as a whole and to show the saliency of different words within and across topics. This visualization gives users an indication of how the field is more than a static two-dimensional space but, rather, a space where topics and values and words interact and change over time. The example of the dynamic fitness landscape shown in Part One has not been assembled from the data within this research. That example serves to show what is possible using the results of this research. And, at varying points within this research, three dimensions plus time have been modeled as sets.

This research is a proof of concept offering the foundation upon which a visualization as such can be built. Future research could begin to model the values within the institutional field as three-dimensional forms based on their relevance, embeddedness (or depth of the value acceptance) and their stability (as measured by the changes in legitimacy or sentiment). The results and outputs of this research provide all the necessary data to support such an endeavor.

The case study context

The following section serves as an introduction to the case study. It provides a historical background to the period during which the 2001 reauthorization of the Elementary and Secondary Education Act (ESEA), known as No Child Left Behind (NCLB), was drafted. This introduction also describes the context in which the majority of states were willing to offer the federal government a more central role in directing public education. This shift is noteworthy, considering that public education is a constitutional right reserved for the states under the 10th Amendment.

In 1983, a report sponsored by the US Department of Education titled, *A Nation At Risk: The Imperative For Educational Reform* opened with the following warning:

> Our Nation is at risk. Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world. This report is concerned with only one of the many causes and dimensions of the problem, but it is the one that undergirds American prosperity, security, and civility. We report to the American people that while we can take justifiable pride in what our schools and colleges have historically accomplished and contributed to the United States and the well-being of its people, the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future -as a Nation and a people. What was unimaginable a generation ago has begun to occur. Others are matching and surpassing our educational attainments (p. 13).

This report alerted us that there was a systemic problem within our education system. The report gave names to these 'problems' and planted seeds from which the narratives of a debate emerged. The statement, "our nation is at risk" insinuated that there were no parties immune to this risk. In this sense, education became a national (and not just local or regional) concern. The federal level of the institutional field became the driving force behind education reform.

The release of the report created an immediate policy problem requiring substantial resources and new ideas to address. The policy problem was clearly defined. Our nation was facing an existential threat because our schools were failing our youth. That existential threat included our financial health as we fell further and further behind our foreign competitors, our moral health as we failed to offer equal chances for quality education to our poor and minority communities, and our physical health or safety as we became weak on the world stage. The message was clear: we must become competitive again by demanding rigor from our students, accountability from our schools, and by guaranteeing

access to quality education for all.

The aforementioned policy narrative motivating and providing justification for U.S. education reform policies maintained a high public profile for at least the following sixteen years. Reform supporters cheered in January of 2002 when George W. Bush signed into law the sweeping federal education reform policy, No Child Left Behind (NCLB), with strong bipartisan support. The Senate voted 87-10 in favor while the House voted 381-41 in favor (Fritzberg, 2012). As a policy, NCLB fundamentally changed the relationships between the states and federal government regarding education. Bush began calling himself "the education president" as the topic received a steady stream of media attention.

The federal NCLB legislation introduced a series of market-oriented mandates requiring that the states set student performance and teacher quality standards and required the states to allow charter schools and school choice. The law established state accountability to the federal government for these obligations. One of the main goals of NCLB was the adoption of standardized metrics and the collection of disaggregated data to be used to measure the performance and progress of students by racial and ethnic groups, gender and income level and teachers by the progress their students made (NCLB, 2001).

Because the policy emerged from the national level of the institutional field and because so much press was devoted to the issue, a visualization of the national level of the institutional field over this period provides significant insight into a changing landscape during turbulent times. Not only does this period of reform offer a rich description as a case study, but it also offers itself as a comprehensive sample from which to explore both paradigmatic perspectives. The policy was based on a production-oriented model,

producing what amounts to ‘units of education’, measurable through standardized testing. The model’s outcome-based approach provides an excellent window into the effects of externalizing and linearizing institutional processes in pursuit of a narrow goal.

Exploratory data analysis

Choosing a topic size is the first step in setting up a topic model. Topic size is subjective in that it becomes a researcher’s judgment as to the level of granularity they wish to observe. Using the logic put forward by Perry and DeDeo (2021) who found that at different topic sizes, “the topic groupings were both stable on re-running the fits, and interpretable, meaning that (after filtering) any particular topic could be associated with a semantic theme, on the basis of both the top words in the topic, and an examination of strongly-loaded posts” (p.5), or in this case, highly weighted articles.

Since the topic number in the model is determined by the researcher, various topic size options were explored to adjust the granularity of the topic model. An exploratory data analysis of 4 topic size variables of 20, 35, 50 and 100 topics was conducted. From the full corpus size of 37,186 articles, an initial sample of 10,000 articles at the topic size 20 was considered first. This model proved useful in finding stop words and getting a sense of the fields that emerged from the data. When the size was set at 20 topics, the model captured a broad range of content per topic.

At this coarse-grained resolution, fields that only tangentially intersect or overlap with the institutional field of education were prevalent in the model outputs. For example, one of the topics appearing from this course-grained resolution showed subject matter that could be labeled tourism and home buying. Newspapers often feature articles discussing

the benefits of certain neighborhoods promoting the local schools or neighborhood features that are of interest to potential home buyers. This information clustered as a topic in the corpus due to the search terms' breadth. The coarse-grain result is not useful when trying to see the signals most relevant to the institutional field of interest in this study. However, it is important to note that fields overlap, and this is an example of that overlapping appearance in the results.

To gain more clarity in choosing a topic size, the 35, 50, and 100 topic size models were compared by graphing the topic distribution. This visual representation of the topics in Figure 26 offers viewers insight into how much of the corpus is clustered into individual topic spaces. In this representation, the "topic weight" is relative to the corpus as a whole.

Sample Size of 10,000 Articles with Topic Size of 35

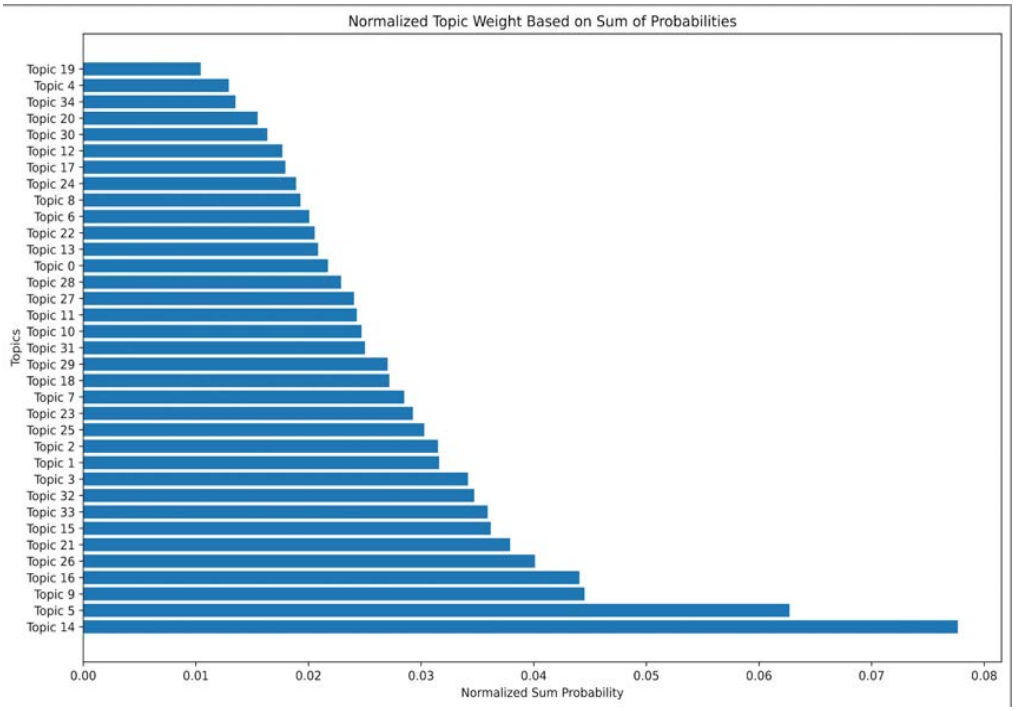

Figure 26: Bar Chart showing the topic numbers (y axis) and their normalized sum probability (x axis) for a topic model producing 35 topics from the corpus. This graph shows the relative weight each topic contributes to the corpus as a whole.

Figure 26 displays the topic distribution when the topic size is set at 35. The length of each bar in the graph corresponds to the prevalence of a topic within the dataset, with longer bars indicating topics that are more frequently represented across the corpus. These longer bars typically reflect major themes or subjects that a significant portion of the documents discuss. Conversely, shorter bars represent topics that are less prevalent, often signifying niche or specialized themes that may be of particular importance in a smaller subset of the corpus. It is important to note that each topic consists of a cluster of terms that appear together frequently, and there can be overlap or relationships between different topics, reflecting the complex nature of the textual data.

This graph is designed to assess the effectiveness of different topic sizes in representing the corpus with LDA. Ideally, LDA users seek a topic distribution where each topic is distinct and meaningful, covering the corpus comprehensively without excessive overlap (to avoid overfitting) or too much generalization (to avoid underfitting).

In analyzing the topic distribution in the sample of 10,000 articles drawn from the corpus using an LDA model, viewers find that the longest bar in the graph accounts for 8% of the topic distribution. While at first glance, such a prominent topic in a large dataset might seem to be capturing a significant theme, it is important to consider the potential for underfitting. Underfitting would imply that our model is too simplistic, leading to broader topics that fail to adequately represent the finer nuances and diversity within the dataset. Therefore, the presence of this large topic and the lack of widely distributed topic weights must be interpreted carefully.

Before finalizing the topic size, it was essential to evaluate whether each topic genuinely reflected a major, cohesive theme of the corpus, or if it indicated a need for further refinement of the model to capture a more detailed and diverse topic structure. The next step in the process of exploratory data analysis looks at the topic content and that step is described next. Before looking at the topic contents, Figure 27 and Figure 28 show the distribution of the topic sizes 50 and 100.

Sample Size of 10,000 Articles with Topic Size of 50

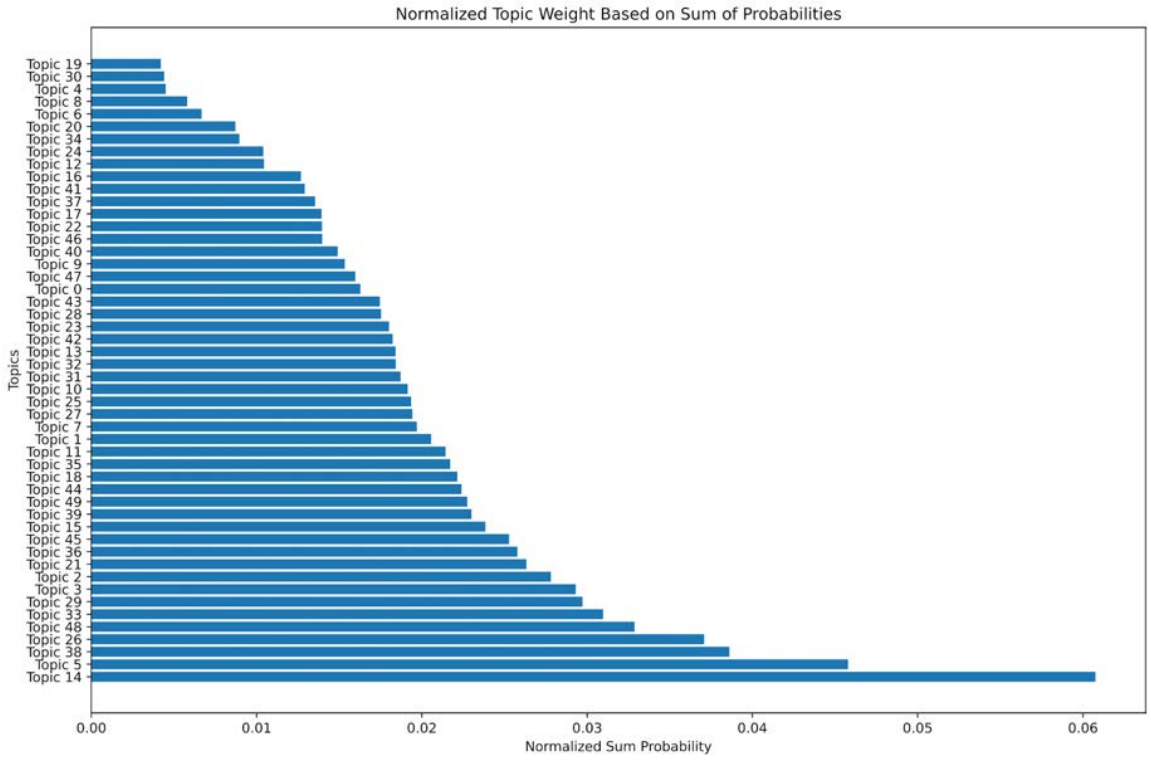

Figure 27: Bar Chart showing the topic numbers (y-axis) and their normalized sum probability (x-axis) for a topic model producing 50 topics from the corpus.

Unlike Figure 26, Figure 27 graph shows a more gradual shift in topic weights which indicates that the topics are becoming more specific. The distribution of topic themes is larger than Figure 26 while still holding substantial weight within the corpus.

The length of the bars and the shape of the distribution indicate that a majority of topics have a fairly even contribution to the entire corpus and the topics include a level of specificity that is greater than what is found in the 35-topic model (Figure 26).

Figure 27, illustrating the 50-topic model, presents a more gradual shift in topic weights compared to Figure 26 (35-topic model). This shift towards a more balanced distribution suggests that no single topic overwhelmingly dominates the corpus, indicative of a more equitable representation of themes. The increased number of topics leads to greater specificity as the model captures more nuanced aspects of the corpus that were perhaps underrepresented in the 35-topic model. The length of the bars and the overall distribution pattern in this graph reveal that a majority of the topics contribute fairly evenly to the corpus. This implies that the 50-topic model achieves a level of detail and specificity preferable to that of the 35-topic model, offering a more granular and comprehensive insight into the corpus. Such a distribution is beneficial for in-depth analysis since it allows for a more thorough exploration of both prevalent and nuanced themes within the dataset.

Figure 28, depicting the 100-topic model, illustrates a notable shift in the distribution of topic weights compared to the models with fewer topics. With the increase in the number of topics, each individual topic weight decreased, as the model allocated the corpus content across a greater number of topics. This is evidenced by the 'long tail' distribution observable in the graph where a few topics have relatively higher weights, dominating the corpus, while a substantial number of other topics contribute only a small fraction each.

Sample size of 10,000 articles with topic size of 100

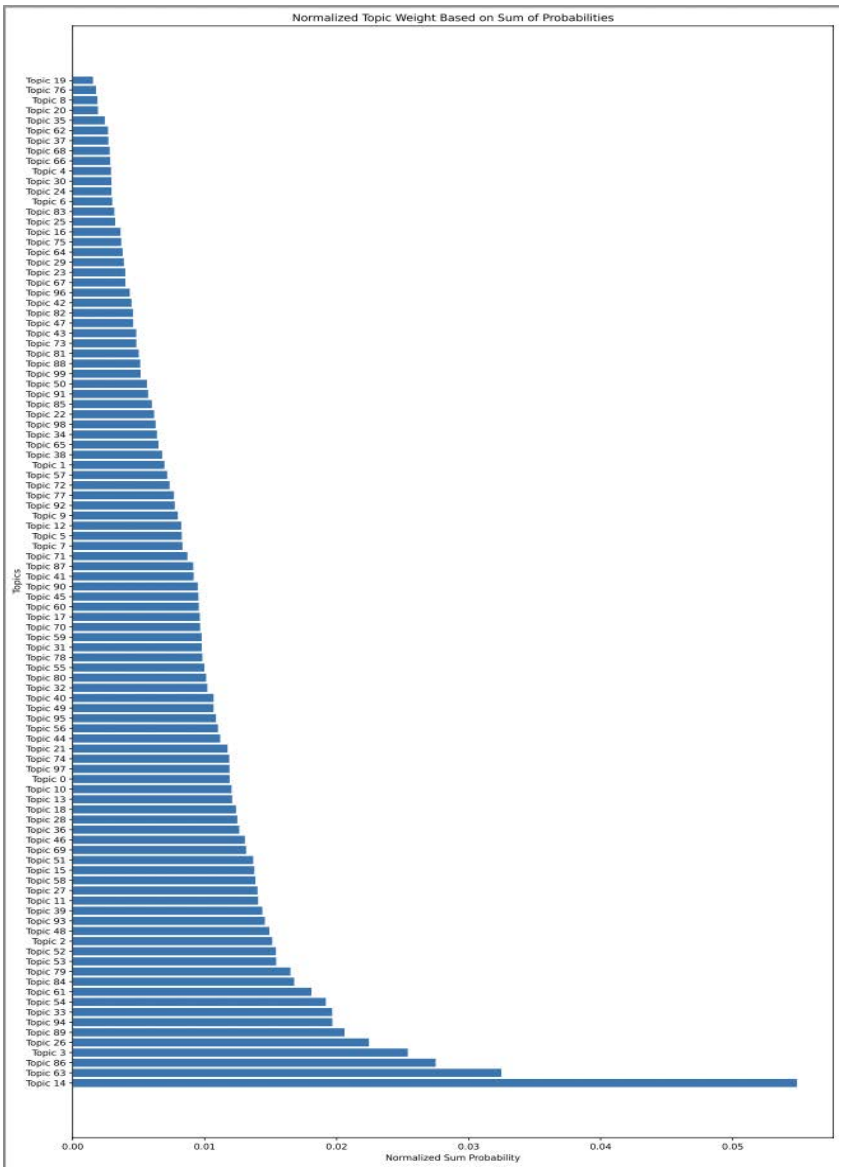

Figure 28: Bar Chart showing the topic numbers (y-axis) and their normalized sum probability (x-axis) for a topic model producing 100 topics from the corpus.

This 'long tail' phenomenon indicates that while the model has identified a broad array of topics, only a few are major themes with significant coverage across the corpus. In contrast, the majority of topics are more specific, capturing narrower or less prevalent

themes. This pattern suggests that the model might be segmenting the data into very fine-grained topics, some of which may represent niche or specific aspects of the corpus that are not broadly represented.

A potential concern with such a distribution is the risk of fragmenting the content too much, leading to an overfitting scenario where the topics become overly specific and possibly less meaningful or coherent as a whole. Importantly, these topics need to be assessed for their interpretability and relevance so that it can be determined if these numerous, finer topics genuinely reflect distinct and meaningful themes within the corpus or if they are artifacts of the model's complexity.

Looking at the shape of the distribution, it was clear that the more topics included in the model, the more disperse the topic weights became. Using this insight, the 50-topic model was preferred because it showed a tapering off of weights but still retained the majority of the topics within the center of the distribution curve.

The final step in determining the optimal topic size for the LDA model involved a detailed examination of the top weighted words for each topic. Initially, the top 30 most highly weighted words for each proposed topic size – 35, 50, and 100 were reviewed (see file in Appendix C) This review was critical in assessing the interpretability and coherence of the topics generated at each size.

In applying the LDA model to a sample of 10,000 articles, it was observed that adjusting the topic size significantly influenced how topics reflected the corpus content. The decision to settle on a 50-topic model was informed by a combination of factors. The topic distribution graphs indicated a more balanced and even representation of topics at

this size, without any single topic dominating excessively. Moreover, the analysis of the top 30 most heavily weighted words within each topic at this size revealed a level of detail and specificity that was comprehensive without being overly fragmented. These words provided nuanced insights into the themes of each topic, demonstrating a degree of specificity that captured the diversity of the corpus while maintaining interpretability and relevance. This balance of granularity and coherence was less evident in the 35 and 100 topic models.

Ultimately, the choice of the 50-topic model was a result of its ability to best align with the research interests, offering a coherent and detailed representation of the corpus that neither oversimplified nor over complicated the underlying themes.

In addition to setting the size of the topic model, configuring the LDA model in scikit-learn involves specifying several other parameters, particularly those related to preprocessing the corpus (see Appendix A for the full topic model script). An essential step in this process is the use of the CountVectorizer class from the sklearn.feature_extraction.text module. This tool serves to transform the text data into a numerical format suitable for the LDA algorithm, a process known as tokenization. Tokenization is vital because it converts textual data into a form that algorithms can more easily analyze.

One important parameter in CountVectorizer is max_features which was set to 5000 for this model. This parameter limits the vocabulary to the 5000 most frequent terms (including words or n-grams) in the corpus. Such limitation helps to focus the LDA model on the most relevant terms while managing computational complexity. The max_features

parameter was crucial due to processing constraints. Limiting the vocabulary to 5000 represents a balance between computational manageability and maintaining a rich enough vocabulary to capture the essential themes of the corpus.

Additionally, the selection of stop words plays a significant role in refining the data. The stop_words parameter was used not only to exclude common English words but also to filter out terms frequently occurring in this specific corpus that offer limited analytical value. Stopwords words such as ‘and’, ‘said’, and ‘be’ tend to clutter the analysis without providing meaningful insight. Based on an examination of the most frequent words in a sample of 10,000 articles from the corpus, a customized list of additional stop words was developed. This list, included in Appendix E, helps ensure that the model focuses on more substantive and contextually relevant terms, thereby enhancing the overall quality and interpretability of the results.

In configuring the LDA model, several other parameters were adjusted to optimize the analysis. The token_pattern parameter was set to ignore words with fewer than three characters. This choice helps to filter out most abbreviations and conjunctions that are unlikely to hold significant meaning in the context of our analysis.

The ngram_range was configured to include both single words and bigrams (word pairs). This setting allows the model to capture phrases like “merit pay” where the combined meaning might be more significant than the individual words. The inclusion of bigrams is crucial for preserving the contextual relationship between words, providing a more nuanced understanding of the corpus.

Two additional parameters, max_df and min_df, were used to refine the features based on their document frequency. The max_df was set to 0.75, meaning that any word appearing in more than 75% of the documents would be excluded. This threshold is relatively high, reflecting a research to goal to encompass as much textual information as possible while still omitting words with little semantic value. On the other hand, the min_df was set to 0.01, excluding words that are too rare (appearing in less than 1% of the documents). This helps to ensure that the features retained are not overly specific to a few documents, thus maintaining a level of generalizability across the corpus.

Parameters Set in LDA

```
# Modifiable parameters for tokenization and vocabulary creation
token_pattern = r'\b[a-z]{3,}\b' # Number of lowercase characters > 3
ngram_range = (1,2) # String of n words (grams) in a row
max_features = 5000 # Upper limit number of unique words
max_df = .75 # Maximum doc frequency a word must have to be considered a fea
min_df = .01 # Minimum doc frequency a word must have to be considered a fea
more_stopwords_list = ['mr','say','would','new','one','said','also','many','

tokenized_data = CountVectorizer(max_df=max_df,
                                 min_df=min_df,
                                 lowercase=True,
                                 stop_words=more_stopwords_list,
                                 ngram_range=ngram_range,
                                 max_features=max_features,
                                 token_pattern=token_pattern,
                                 analyzer='word')
                                 ## custom stopwords list will need to be qu

# Produce document term matrix
```

Figure 29: Screenshot of a cell within the topic model script that shows the parameters used in the final topic model for analysis.

The choice in parameters was guided by the objective to balance the inclusion of a wide range of relevant words while excluding those that contribute little to the overall understanding of the corpus. The aim was to create a model that captures a comprehensive yet meaningful representation of the textual data, suitable for the research goals. Figure 29

is a screenshot image of the cell containing the majority of the parameter configurations.

The topic model, once trained on this dataset, produced two key types of output files. The first was the document-topic distributions for each document indicating the probability weight of each topic within that document. This reveals how topics are distributed across individual documents in the corpus. The second output was the word-topic distributions which show the probability of each word belonging to a given topic, providing insight into the composition of each topic.

To effectively analyze and interpret these results, they were transformed and visualized using various tools. Inside Jupyter notebooks, Python was utilized to process and visualize the data in a flexible, code-based environment. Additionally, some of the results were exported to Excel for further analysis, allowing for a more traditional spreadsheet-based approach to data handling.

Prior to transforming data within Jupyter notebooks or exporting it for analysis in Excel, the results were normalized as appropriate for each specific analysis form. This normalization process was crucial to ensure that the data were on a comparable scale, facilitating more accurate analysis and visualization.

Furthermore, the LDAvis Python library played a significant role in this analysis. LDAvis directly took the results from the model to create an interactive web-based visualization. This tool is specifically designed for topic models produced by algorithms like Latent Dirichlet Allocation (LDA). As described earlier, it offers an intuitive interface for exploring the relationships between topics and the terms that constitute them, making it an invaluable asset for understanding and presenting the complexities of the topic model.

These various methods of transformation and visualization were instrumental in extracting meaningful insights from the topic model, catering to the diverse analytical needs of this research.

Topic modeling: getting a lay of the land

Analyzing the metadata offers a comprehensive overview of the corpus's content (see Appendix D for the full corpus' metadata). It reveals a diverse composition: 6,960 articles from *The New York Times*, 7,510 from the *Chicago Tribune*, 7,371 from the *Los Angeles Times*, 13,842 from *The Washington Post*, and 1,565 from T*he Wall Street Journal*. Additionally, by examining the 'Titles' field in the metadata, further insights were gained by conducting a targeted search within the spreadsheet, looking for specific words in the article titles. Table 3 shows a list of those words and the findings. Note that the searches have not been reconciled for duplicates. For example, if 'education' appears in 2588 titles and 'K-12' appears in 22 titles, it is not known, from the search alone, whether 'K-12' is included in the 2588 total of 'education' titles. In Table 3, 'Parent', 'parents', 'parent' is highlighted to show the difference in results when subtle changes are made to the search criteria.

Table 3 shows, on the left, the terms appearing in the titles and, on the right, the number of articles in which those terms appear. The choice of terms is intended to represent some general content topics that are likely to appear in a corpus representing the institutional field of American K-12 education during that time. The list is not comprehensive but instead reflects a general exploration of the data. For example, out of 37,186 articles, 11,127 of them use the word 'school' in their title.

Frequency of Selected Keywords in Article Titles Across Publications

Word search in Title	Number of titles with the word
education	2588
school	11,127
K-12	22
teacher	1732
student	2010
state	2104
funding	367
learning	306
union	297
parents	739
parent	843
Parent	843
pupil	305
principal	308
superintendent	206
report card	103
court	617
reading	294
drug	152
class	1091

Table 3: This table displays a selection of words on the left and the number of titles within the corpus that include the word shown on the right.

To assess the coherence and relevance of the corpus, the first 1000 articles in the metadata file were analyzed with a focus on identifying outlier titles. These outliers were defined as titles that did not directly pertain to the primary themes of education or schooling. Instead, they included articles that indirectly related to these themes, as well as those clearly referencing foreign affairs, local officials such as mayors or chiefs of police, or transportation topics.

The analysis yielded the following findings. Among these outliers, 20 articles were identified with titles that were proper names. These articles were located, and their content reviewed. It was surprising to find that these articles were obituaries, especially since obituaries had been filtered out in the initial database search. These obituaries, however, were all about former educators and school staff so there may have been a unique feature to the article that allowed them to pass undetected through the filter.

In addition to these obituaries, the analysis also identified a book review, several recurring newspaper sections with titles like Almanac, Benefits, Inside, and Positively Ignored, four marriage announcements, two real estate-related articles, and 17 international news pieces, some under sections titled “World Briefing Europe" or “The World.” This assortment of outliers seemed reasonable and did not raise concerns about the overall quality of the corpus. The presence of such diverse topics suggests an acceptable range of content, aligning well with the primary focus areas of the dataset, despite the unexpected inclusion of specific obituaries.

There was an interest in exploring how individual articles were associated with specific topics, particularly in terms of their topic weights. To investigate this, an analysis

was conducted on an article titled “Guns in Schools” (published on 2001-05-20 in the *Chicago Tribune*, goid = 419282201), which, as the title suggests, seemed to be closely aligned with a specific topic. The goal was to determine which topic(s) this article was most heavily associated within the LDA model.

In the LDA model, each document in the dataset is associated with a range of topics through a document-topic matrix (file found in Appendix F). This matrix assigns weights to each topic for every document, indicating the extent to which the document is related to each topic. For example, in the case of the article titled “Guns in Schools,” the topic weights are distributed to reflect its relevance to various topics. The highest weight is .61179 in Topic 24, indicating a strong association with this topic. This is followed by lower weights of .14 in Topic 8, .13 in Topic 23, .07 in Topic 30, and a very minimal .0007 in Topic 0.

These weights signify the degree of correspondence between the article and each topic, with higher weights indicating a stronger relevance. It is important to note that in this model, every article has some level of association with each of the topics, but the degree of this association can vary significantly. Some topics may have very small weights for a particular article, suggesting a minimal or tangential connection.

In an in-depth analysis of Topic 24, to which the article “Guns in Schools” has the strongest association, it became evident that the topic encapsulates the overarching theme of 'drug/violence/crime'. This correlation is further confirmed by the temporal distribution of Topic 24, as depicted in Figure 30. The graph shows a marked increase in the topic's prevalence around the publication date of the article, suggesting a notable relevance of this

specific theme during that period.

Topic 24

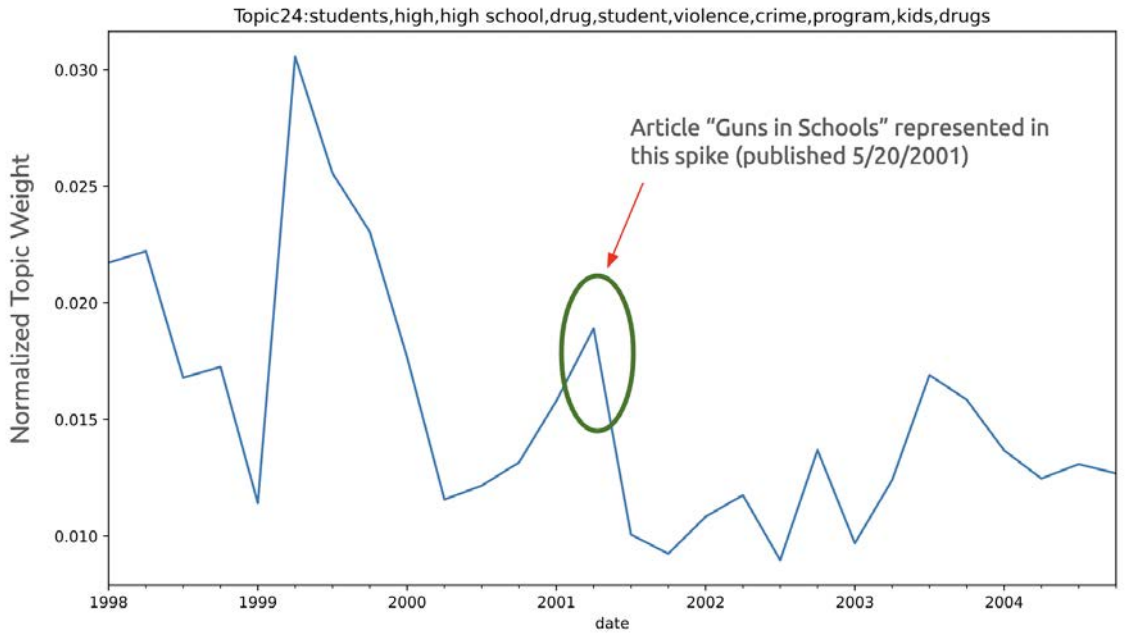

Figure 30: Graph of Topic 24. Y-axis shows normalized topic weight and x-axis shows the time period from Jan. 1, 1998 to Dec. 31, 2004. The green circle indicates where the article "Guns in School" is represented on the graph.

To contextualize the prominence of "Guns in Schools" within Topic 24, Table 4 is provided, listing the top 5 articles with the highest relevance to this topic. This table not only illustrates the article's relative significance within the topic but also sheds light on the thematic consistency among the top-ranked articles. Further, the article's metadata provides deeper insights into its content and alignment with Topic 24.

Moreover, Table 5 offers a comparative perspective by ranking "Guns in Schools" among all articles associated with Topic 24, based on their respective topic weights. Occupying the 35th position in this ranking, as determined by the sum of probabilities, the article demonstrates a substantial but not dominant association with the topic. This rank,

alongside the content analysis and temporal distribution, collectively demonstrates the alignment between the thematic topic content, the thematic focus of the articles, and their temporal relevance, thereby offering an indication of the coherence and validity of the topic model.

Top 4 Articles for Topic 24

Topic Number	Article goid	Article normalized weight within topic	Article Citation
24	432902360	0.001550702	Crime in Schools Fell Sharply Over Decade, Survey Shows, 2004-11-30, *New York Times*
24	421340180	0.001444135	NEWS IN BRIEF: A summary of developments across Los Angeles County; Community News File / Los Angeles; Weapons Crimes Up 7% in Public Schools , 1998-10-03, *Los Angeles Times*
24	4309344117	0.001355161	Study Finds No Big Rise in School Crime, 1998-03-25, *New York Times*
24	419162452	0.00126079	Girls' recent violence puts spotlight on female gangs, 2004-05-03, *Chicago Tribune*

Table 4: This table was taken from a spreadsheet to show the top 4 articles for Topic 24 based on the article's normalized weight within the topic. Column 1 is the topic number (24); Column 2 shows the unique article identifier; Column 3 is the normalized weight of the article within that topic; Column 4 is the article reference information.

Normalized Document Weight for the Top 25 Articles in Topic 24

	Goid	Article weight
24	432902360	0.0015507
24	421340180	0.00144414
24	430934117	0.00135516
24	420153380	0.00128566
24	419162452	0.00126079
24	421422381	0.00123026
24	418627125	0.00122712
24	421339946	0.00120926
24	418598618	0.00119613
24	398832409	0.00116811
24	418636060	0.00115336
24	398690036	0.00113362
24	419856299	0.00113318
24	418934590	0.00112899
24	419998735	0.0011195
24	419845008	0.00111917
24	418817376	0.0010944
24	419877469	0.00108999
24	418711414	0.0010829
24	431016892	0.00107747
24	418866032	0.00107318
24	431701401	0.00106498
24	431788770	0.00106453
24	419282201	0.00105934
24	419179768	0.00105157

Table 5: Table displaying the goid (column 2) and article weight (column 3) for top 25 articles in topic 24. Article "Guns in Schools" is listed as the 24th most heavily weighted document highlighted by the red arrow.

Next, the distribution of the 50-topic model was revisited with the objective of analyzing the weight of specific topics relative to the entire corpus (Figure 31). This graphic provided insights into the content of the topics at both ends of the distribution spectrum: the most heavily weighted (or prevalent) and the least weighted (or specific) topics. In topic modeling, it is common to find that topics at these two extremes can represent different kinds of 'noise'. On one end, a topic might become a 'catch-all',

Full Corpus Topic Model of 50 Topics Distribution

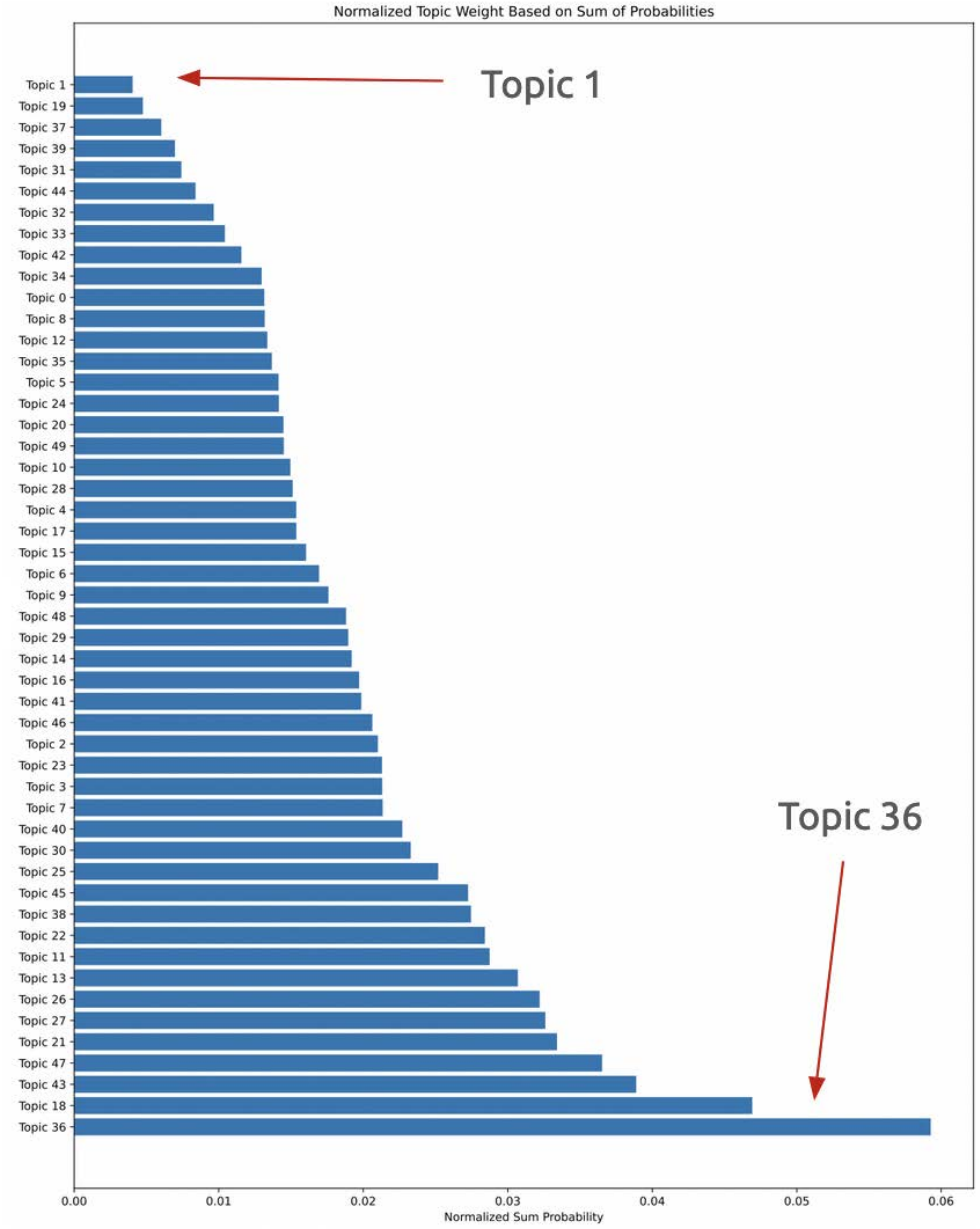

Figure 31: Topic distribution of the full corpus (37,186 articles) at 50 topics. Topic 1 and Topic 36 are identified with red arrows.

aggregating miscellaneous content that doesn't fit well into other topics. On the other end, some topics might be overly narrow, capturing very specific attributes that group a small set of articles together.

A visual examination of the topic weight distribution in the final 50-topic model revealed some interesting patterns (Figure 31). Topic 36, appearing at the lower end of the distribution chart, seems to fit the profile of an overly broad, catch-all topic. Conversely, at the opposite end of the spectrum, Topic 1 stands out for its specificity. With a Normalized Sum Probability of 0.004043792, Topic 1 is one of the least prevalent topics. The top 10 words associated with Topic 1 are: 'closed', 'edison', 'county', 'offices', 'holiday', 'libraries', 'state', 'library', 'federal', 'open'. These terms suggest a narrowly focused topic, predominantly concerning closures and possibly in relation to holidays. This specificity in Topic 1 exemplifies the kind of narrowly defined subjects that can emerge in topic modeling, particularly in models with a larger number of topics. Table 6 displays the top 5 most heavily weighted articles for Topic 1. The article titles confirm that this topic is about holiday closures.

To better understand Topic 36, which emerged as the most heavily weighted topic in the corpus, the most representative articles were identified and examined. First, the top 5 articles with the highest weights within Topic 36 were compiled, as listed in Table 7. A preliminary review of their titles already suggests a broader and more varied content compared to the narrowly focused Topic 1.

Top 5 Most Heavily Weighted Articles for Topic 1

Unique article id	Title	Date	Publication
421458356	Holiday Closures	1999-12-31	Los Angeles Times
421313703	Holiday Closings	1998-11-25	Los Angeles Times
421516282	Holiday Closures	2000-01-01	Los Angeles Times
419607949	Thanksgiving Day	2002-11-27	Chicago Tribune
421512741	Holiday Closings	1999-02-11	Los Angeles Times

Table 6: This table displays the top 5 most heavily weighted articles for Topic 1. Column 1 holds the unique article id, column 2 holds the article title, column 3 holds the article data, and column 4 holds the article publication.

Using Topic 36 article metadata, a detailed analysis was conducted to gain deeper insights into the nature of Topic 36's content. This involved a close reading of each of the top 5 articles, paying particular attention to themes and narratives. This analysis revealed that Topic 36 tends to serve as a catch-all category, predominantly featuring nostalgic reflections on school days. The articles in this topic often weave memories or idealized depictions related to school experiences. For instance, some articles presented diary-like stories or recollections of romantic first encounters in school settings, like a first kiss. Others included tributes to mothers, perhaps as part of a student project for Mother's Day (as indicated by titles like 'M is For'), or stories offering advice with references to being a 'good student.'

Overall, the diverse nature of Topic 36, as exemplified by these articles, underscores its role as a broad category within the corpus, capturing a range of narratives

and reflections centered around school life and experiences.

Top 5 Most Heavily Weighted Articles for Topic 36

Unique article id	Title	Date	Publication
431443380	M Is For . . .	2000-05-14	New York Times
409733332	Stephanie Navarro - Resident assistant, Georgetown University	2004-05-02	The Washington Post
418700773	IT'S OVER -BUT EX ISN'T OUT OF THE PICTURE	1998-10-27	Chicago Tribune
430925974	Metropolitan Diary	1998-02-09	New York Times
419292020	LOVE REVIVED AFTER 74 YEARS HAS ITS BRIEF DAY	2000-12-26	Chicago Tribune

Table 7: This table displays the top 5 most heavily weighted articles for Topic 36. Column 1 holds the unique article id, column 2 holds the article title, column 3 holds the article data, and column 4 holds the article publication.

The exploratory data analysis process laid a robust foundation for understanding the diverse and intricate patterns within the dataset. This preliminary investigation not only illuminated key aspects of the corpus but also provided valuable context for the detailed examination that follows.

Moving forward, the focus shifts to the direct outputs of the topic model. The next section delves into the specific results generated by the model, offering a deeper and more structured understanding of the topics that have emerged from the analysis. The model's findings will be explored, focusing on the representation of selected topics, the relationships among them, and the broader narratives they collectively reveal. This

examination aims to glean more precise insights from the model, bridging the gap between raw data and meaningful interpretation.

Sorting and categorizing the topics

LDA topic modeling uses an algorithm to identify topics in a set of documents by grouping together words that frequently appear in the same contexts. However, these topics are initially just collections of words with associated weights, and they don't have human-readable labels. It is the job of the researchers to interpret these groups of words and assign meaningful labels to each topic.

To do this, researchers typically examine the most prominent words in each topic. These are the words that the algorithm has determined are most strongly associated with that topic. By looking at these words, researchers try to understand the common thread or theme that ties these words together. For example, Topic 37 in this model includes words like 'food', 'lunch', 'milk', 'fruit', a researcher might label this topic as 'School Lunch'.

This process requires a good understanding of the content and context of the documents in the corpus, as well as some degree of subjective judgment. Researchers need to make informed decisions about what each list of words represents in the real world, which can sometimes be challenging, especially for topics that are less clear-cut or more abstract. In essence, labeling topics in LDA is a mix of art and science: it combines the algorithm's statistical analysis with the researcher's contextual knowledge and interpretive skills.

In this analysis, the LDA model generated 50 topics. The challenge lies in interpreting these topics and grouping them in a manner that aligns with the research objectives. Among these 50 topics, some may be overly broad or narrow, or they may not

align with the central research focus. The subsequent section describes the methodology used to sort, select, and categorize the topics in this investigation, ensuring that the analysis remains focused and relevant to the overarching research goals.

Topic models can generate an extensive array of graphs. Appendix H has a file that includes graphs for all 50 topics. To manage this volume of data effectively, the individual topic graphs were organized into 'Themes', creating categories that encapsulate similar patterns or characteristics. This grouping is a crucial step where the researcher's interests guide the classification of topics. There are multiple ways to approach this grouping; in this case, the topics were categorized based on the patterns reflected in their trend lines. The assumption was that topics exhibiting similar temporal patterns likely engage with similar themes or subjects at a field level.

After establishing these thematic groups, a detailed review of the topics within each group was conducted. This review ensured that each topic's inclusion in a particular group was appropriate, reinforcing the thematic coherence of the categories.

The process of categorizing the 50 topics, as derived from the full dataset results of the normalized topic model graphs over time, involved the application of specific criteria:

1. **Shape of the Trend Line**: Each topic's trend over time was analyzed and sorted based on its shape - whether it was inclining, declining, showed a pattern of surges (rise and fall), or exhibited a single spike within a certain period.
2. **Pattern of Signal in Relation to Other Topics**: Topics were compared to identify any that had patterns mirroring each other. For instance, if one topic's trend line was the inverse of another's, they were grouped together, suggesting a complementary or oppositional relationship.
3. **Topic Content**: This criterion was particularly significant as it directly pertains to

the essence of each topic. Given that all topics originated from a corpus defined by specific search terms related to education, the final categorization was heavily influenced by how closely the content of each topic aligned with these themes. As topic graphs were sorted based on their shape, the topic content was also reviewed so that topics of unrelated fields (like election cycles, building projects, etc.) or tangentially related areas (such as extracurricular activities, weather events, or higher education) were removed.

Further, a topic's overall weight within the corpus was noted, but this factor primarily served as a tiebreaker when a topic seemed to overlap between two or more thematic categories. For instance, topics that represented 'background' narratives, marked by their relatively low weight and specific discourse intensity, were grouped together. Conversely, if a topic with similar content had a significantly higher weight, it was placed in a different category than the 'background' narrative.

After narrowing down the topics by removing 22 that were too tangential to the core interest of the reform period centered around NCLB, attention turned to the organization and labeling of the remaining topics. This stage involved a deeper analysis of the topic groups, each now defined by common characteristics or themes. The process of labeling was guided by the distinct identifying features observed within these groups.

As a result, six distinct categories emerged, each encapsulating a specific aspect of the education discourse as captured in the analysis. The categories were named to reflect their core themes and characteristics. The named categories that materialized from this process include *Structural Components and Key Players,* representing the fundamental elements and influential figures in education; *Pushed Narrative*, encompassing the

prominent stories or agendas being advanced; *Internalized or Externalized*, differentiating between topics focused on internal (institutional) versus external (societal) factors; *Disturbance*, highlighting topics related to disruptions or challenges in the education system; *Local Reflections*, capturing topics with a more localized or community-centric focus; and *Punctuating the Equilibrium*, which includes topics that signify significant shifts or milestones in education discourse.

The following breakdown showcases each category, labeled as a theme, alongside its corresponding topics. In addition, the themes are represented graphically to highlight the topics' interrelation. The topics were labeled based on a few of the most heavily weighted topic words. If a topic title does not include 'quotes', the words were pulled directly from the list of top 10 weighted topic words. If the topic title has 'quotes', the topic title was not taken directly from the topic words, instead, the title is descriptive of the topic content. The topic numbers, as generated by the model, are for reference only and have no intrinsic significance beyond identification. It should be noted that the numbering in the LDAvis visualization assigned different numbers to the topics. Although the topics, themselves, are the same, the number referencing them are different. Therefore, the LDAvis topic number is provided in parentheses for cross-reference.

THEME 1: Structural Components & Key Players

Topics included in this theme:

Topic 29 (24) - Union / Political / Leaders

Topic 26 (7) - Teachers / Principals / Students (education/teaching)

Topic 25 (13) - School Board / Superintendent / School System

Topic 40 (15) - Charter / Program

Theme of 'Structural Components & Key Players' Topics over Time

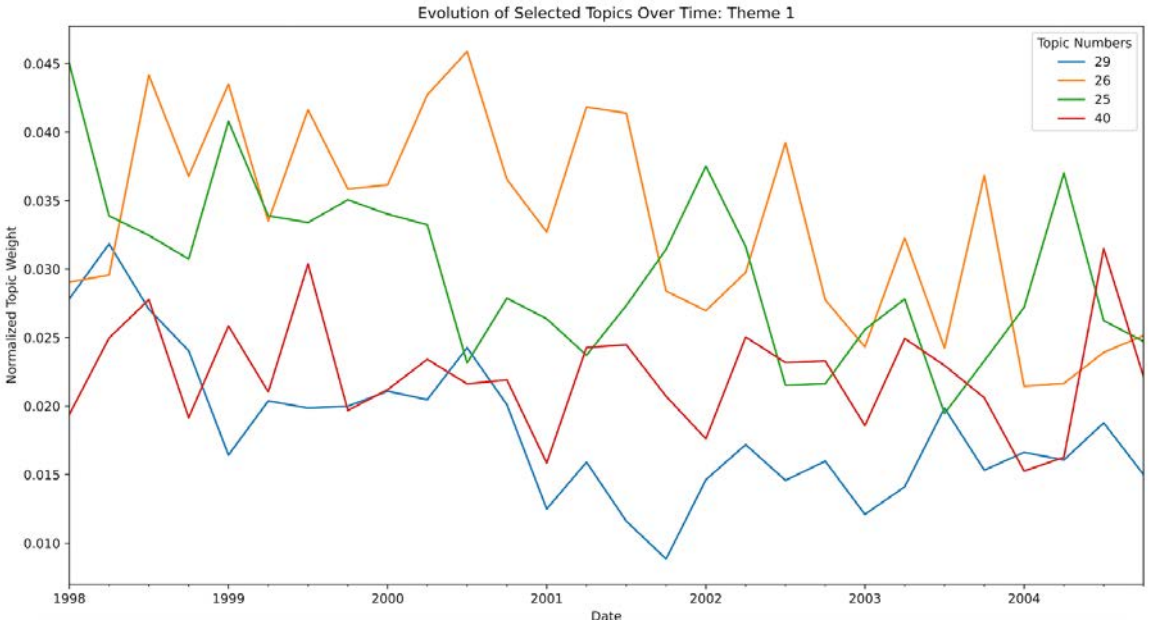

Figure 32: This graph shows the change in topic weight for each topic included in the theme: Structural Components & Key Players.

Figure 32 shows the theme: *Structural Components & Key Players*. Using this graph, viewers can compare how much of the conversation was dedicated to each of these topics and how they changed over time.

THEME 2: Pushed Narratives

This theme displays patterns of a turbulent, rise/fall aspect of the narrative. The normalized topic weight in Figure 33 provides information regarding the amount of discussion/narrative/article content this topic represents in relation to the corpus as a whole. The pattern suggests a cycle, where a single spike is followed by steep decline. The spike followed by steep decline indicates that the narrative required an effort or energy applied to the issue for it to rise to the level of attention in the narrative. If that effort is not sustained, the topic falls out of the discourse.

Theme of 'Pushed Narrative' Topics over Time

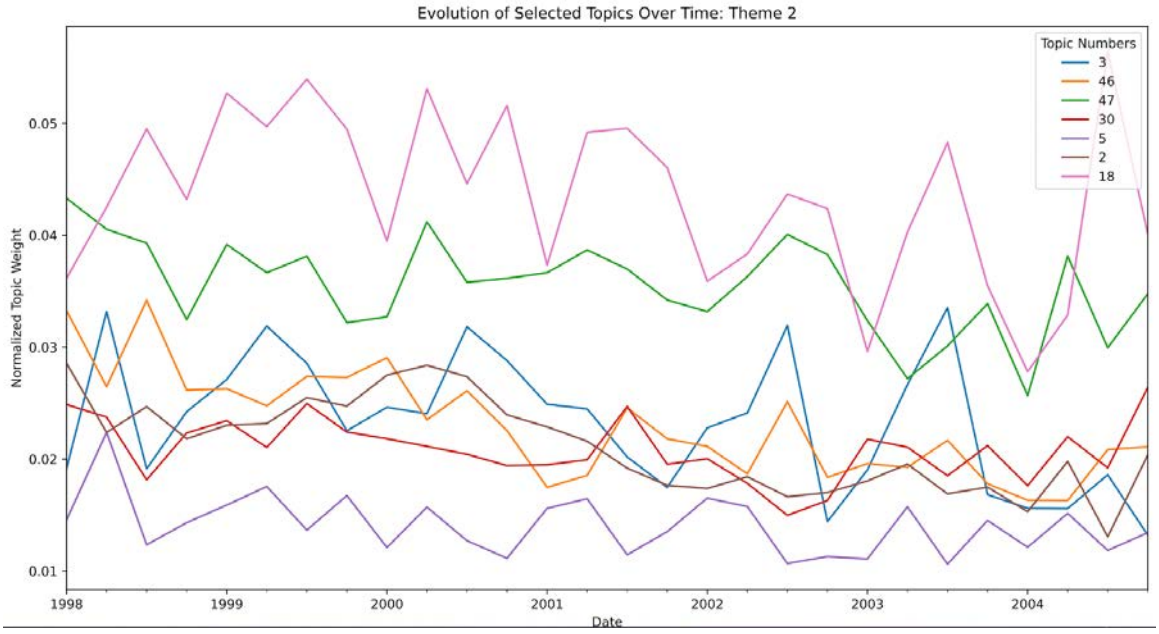

Figure 33: This graph shows the change in topic weight for each topic included in the theme: Pushed Narrative. Topic 5 has a consistently low topic weight over time (spiking just above 0.02) and Topic 18 has a consistently high topic weight over time (spiking at 0.05).

Topics included in this theme:

Topic 3 (19) - Private / Vouchers / Special / Parent

Topic 46 (21) - School District / Officials / Construction

Topic 47 (4) - Home / Kids / Parent / Grade / Teacher
Topic 30 (14) - ‘Humanities’ - books, history, world/American, story
Topic 5 (36) - Art/Music/Dance/Theater/Program
Topic 2 (17) - Technology / Computer / High School
Topic 18 (2) Test / Scores / Percent / Standards (includes Math / Reading)

There are two items to note regarding Topic 3 and Topic 47. Categorizing Topic 3 posed a challenge, as it seemed to align with two potential themes: *Structural Components & Key Players* and *Pushed Narratives*. Ultimately, the decision to assign Topic 3 to *Pushed Narratives* was influenced primarily by the characteristics of its trend line. This approach aligns with the previously established methodology of prioritizing the trend line's shape over the topic's specific content when sorting topics into their respective categories or themes.

Topic 47 serves as a key example illustrating the decision not to apply lemmatization (reducing words to their root forms) in this research, emphasizing the need to preserve the nuanced context within the large discourse. In this topic, the singular form 'teacher' frequently appears in conjunction with words like 'children', 'parents', 'home', 'kids', and 'class'. This specific usage suggests personal, direct references to teachers, as exemplified in phrases like “My child’s teacher is Ms. Fitch.”

In contrast, 'teachers' in its plural form, featured prominently in Topic 26, aligns more with discussions about the collective or organizational aspect of teachers, referring to a generic group or the profession as a whole. This distinction between 'teacher' and 'teachers' underlines the importance of context in understanding discourse, a subtlety that would have been lost with lemmatization.

THEME 3: Internalized or Externalized: clear incline or decline in topic narrative

Topics included in this theme:

Topic 6 (27) - English / Immigrants / Latino / Language (decline)

Topic 15 (28) - 'Community Life' (incline)

Topic 43 (3) - Budget / Money / Spending / Plan / Governor (incline)

Topic 35 (39) - Montgomery / Maryland (incline)

Topic 32 (44) - Loudoun / Fairfax / Virginia (incline - steep just prior to NCLB)

Theme of 'Internalized or Externalized' Topics over Time

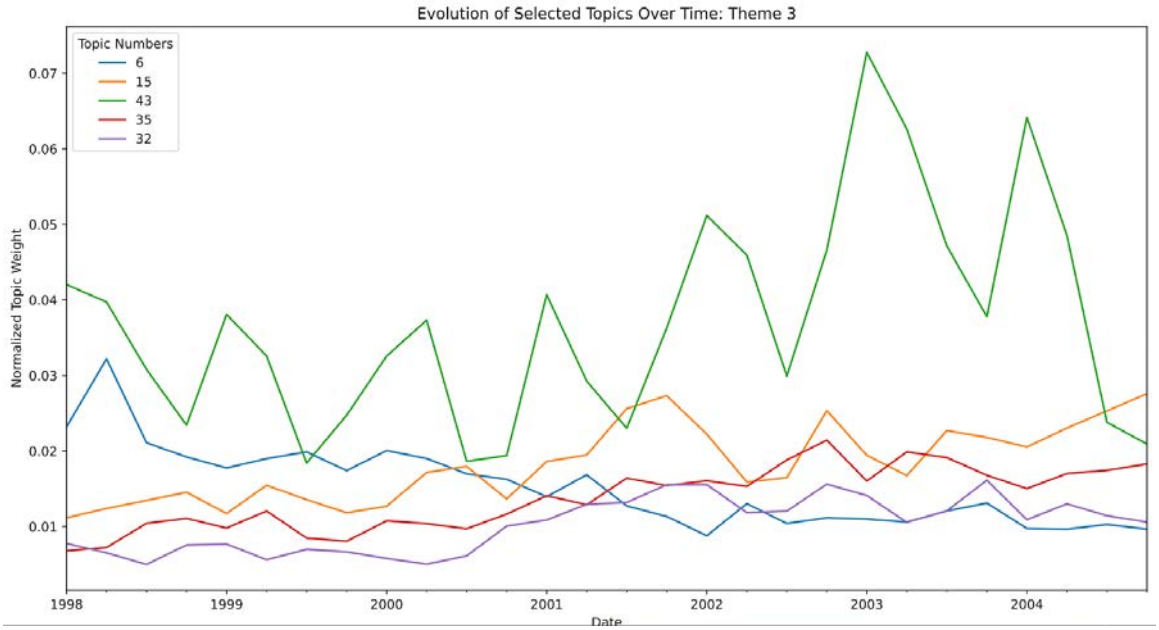

Figure 34: This graph shows the change in topic weight for each topic included in the theme: Internalized or Externalized.

In the *Externalized or Internalized* theme shown in Figure 34, analyzing the temporal trends of topic weights in the corpus reveals distinct patterns of change. Topic 6 (blue line), for instance, exhibits a noticeable decline in weight over time, indicating a diminishing presence or relevance in the discourse. On the other hand, Topics 32 (purple line), 35 (red line), 15 (orange line), and 43 (green line) demonstrate an upward trend,

suggesting an increasing significance in the narrative.

These shifts in topic weights over time provide insights into the dynamics of the discourse. An increase in a topic's weight implies that the subject matter associated with that topic is becoming more prevalent, possibly indicating a growing focus or interest in that area within the narrative. Conversely, a decreasing trend points to the topic's content being gradually phased out or receiving less emphasis in the discussions. Such trends offer valuable clues about how certain themes or topics are either being brought to the forefront and amplified or being sidelined and diminished in the evolving narrative.

THEME 4: Disturbance (distinct spike in the graph)

Theme of 'Disturbance' Topics over Time

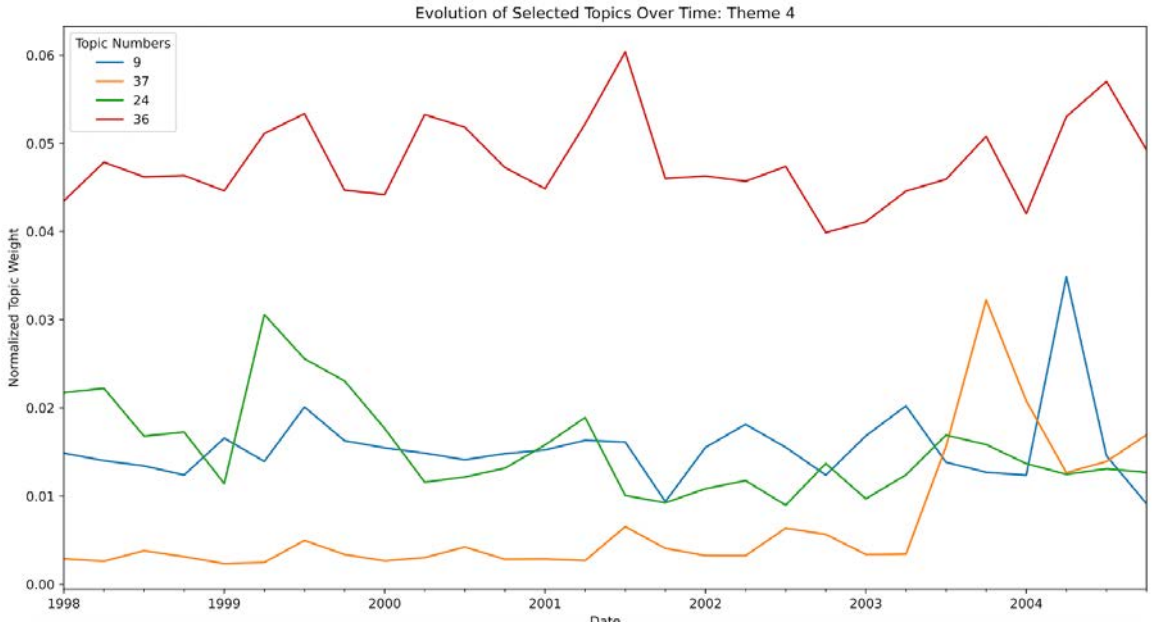

Figure 35: This graph shows the change in topic weight for each topic included in the theme: Disturbance.

Topics included in this theme:

Topic 9 (26) - Race / Black / White / Percent / Minority

Topic (48) - 'School Lunch'

Topic 24 (35) - Drug / Violence / Crime / Program

Topic 36 (1) - 'Family Life Values'

The thematic name *Disturbance* was assigned to these topics (shown in Figure 35) due to noticeable spikes in the graph which reflect significant increases or decreases in the topic's weight at certain points in time. For instance, in the graph, Topic 36 is represented by a red line that shows a sharp spike in June 2001. Similarly, Topic 24, marked by a green line, peaks in March 1999; Topic 9, depicted with a blue line, reaches its highest point in March 2004; and Topic 37, indicated by an orange line, experiences a notable spike in

September 2003.

THEME 5: Local Reflections

Theme of 'Local Reflections' Topics over Time

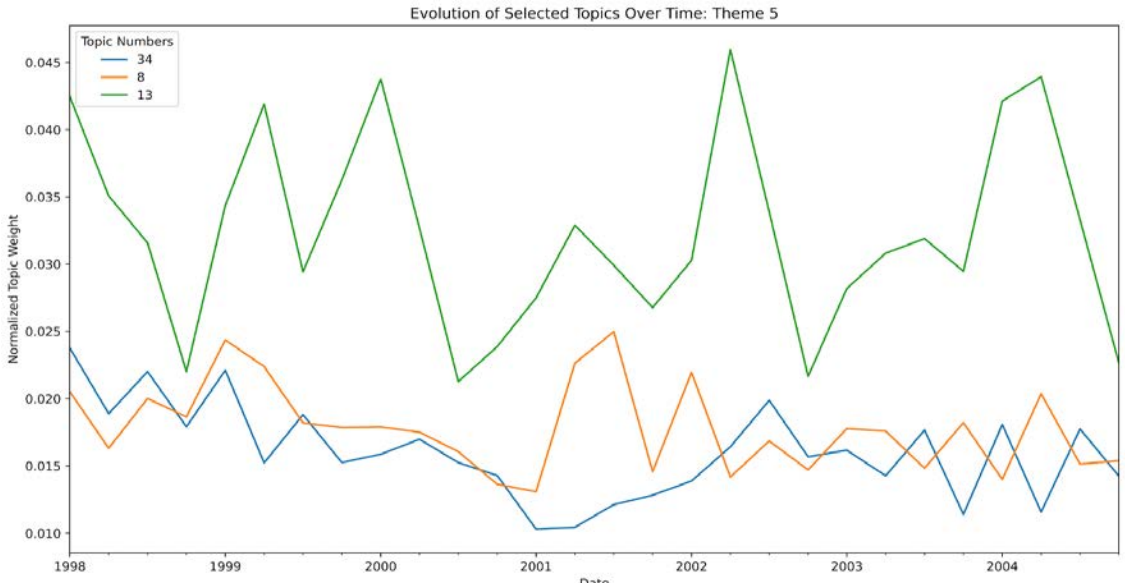

Figure 36: This graph shows the change in topic weight for each topic included in the theme: Local Reflections.

This category (shown in Figure 36) is named *Local Reflections* because Topic 34 stood out as a reflection of Topic 13. The category formed around the similarities of this topic's unique (and yet unexplored) relationship to the national level discourse.

Topics included in this theme:

Topic 34 (38) - District / State / Chicago

Topic 8 (40) - Chicago / Chicago Schools / Mayor / Tribune

Topic 13 (8) - Mayor / Education / Chancellor / Control

Topics are often nouns so it is interesting to see the word "control" listed in Topic 13, which may be used in this instance as a noun.

THEME 6: Punctuating the Equilibrium

The general trend in this category shows an abrupt change around the passing of NCLB. The topic content confirms that this is the discourse affiliated with the national interests (such as Topic 27 with "life", "believe", "good", "right", "american", "need"), politics, and the battle playing out in the passage of the NCLB bill itself.

Theme of 'Punctuating the Equilibrium' Topics over Time

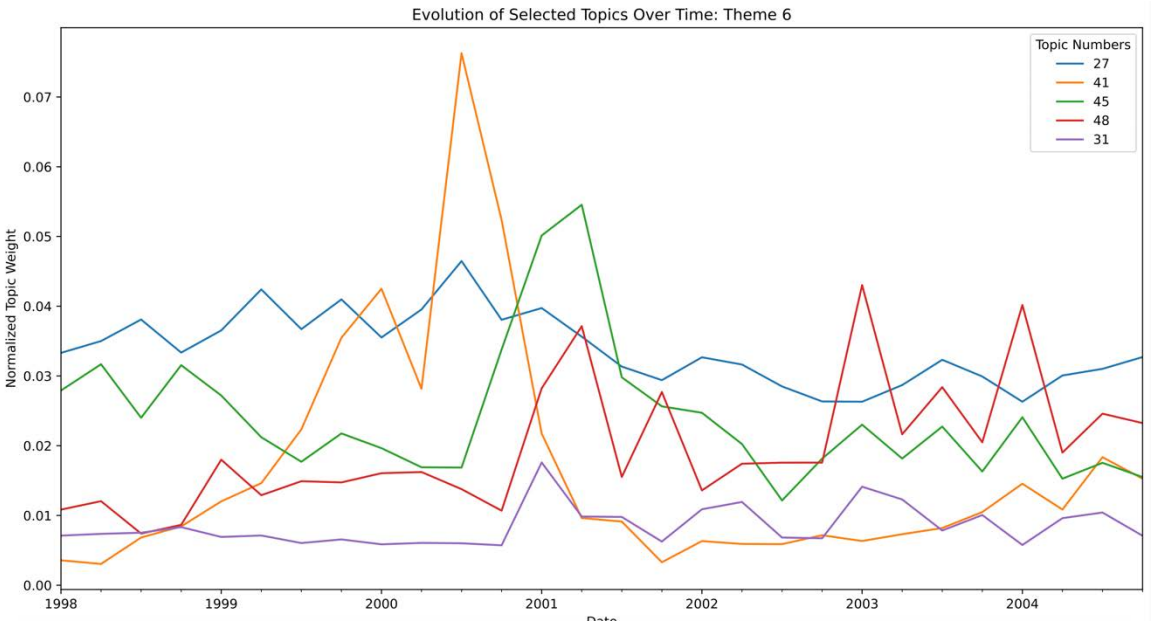

Figure 37: This graph shows the change in topic weight for each topic included in the theme: Punctuating the Equilibrium. The feature that is common in these topics is a spike around the time of NCLB's passage in 2001.

Topics included in this theme:

Topic 27 (5) - 'American Values and National Interests'

Topic 41 (20) -'President Bush and His Campaign'

Topic 45 (11) - 'Political Parties and Moving a Bill through Congress'

Topic 48 (25) - 'NCLB'

Topic 31 (41) - 'NCLB Players'

The overarching trend within this category indicates a significant shift in discourse around the time of the No Child Left Behind (NCLB) act's passage (Figure 37). The nature of the topics within this category, such as Topic 27 which includes words like 'life', 'believe', 'good', 'right', 'American', and 'need', suggests a focus on national interests and political dynamics integral to NCLB's legislative journey.

This theme, *Punctuating the Equilibrium*, is characterized by topics that show notable activity around the 2001 enactment of NCLB. While Topic 31 shares similarities with the 'Disturbance' theme, topics were categorized under *Punctuating the Equilibrium* for two key reasons. First, unlike the isolated spikes observed in the *Disturbance* theme, Topic 31's prominence during the NCLB period was more prolonged with its relevance fluctuating in the discourse beyond just the enactment period. Second, the content of Topic 31, primarily comprised of a list of names not directly linked to any specific event or high-profile figures, does not align with the *Disturbance* theme's characteristics. These names found in this topic warrant further investigation to understand their connection to the shifts in narrative around the NCLB event.

Close read of topics: from seeing the landscape to understanding the landscape

To gain a deeper understanding of the topics identified in the Structural Components and Key Players theme, the hand coding method of Narrative Value-Based Coding (NVBC) was employed on the five most heavily weighted articles within each topic. Narrative Value-Based Coding is guided by the 'Core NPF Variables' from the *Narrative Policy Framewo*rk (McBeth et al., 2014) which defines a policy narrative through four elements: setting, characters, plot, and moral.

In NVBC, ‘setting’ is interpreted as the ‘issue’, providing the context or backdrop of the narrative. ‘Characters’ are coded as “hero” or ‘villain’ representing the forces perceived as beneficial (‘heroes’) or harmful (‘villains’) to the system. The ‘plot’ of the narrative is understood as ‘wants’ and ‘actions to take’ outlining the objectives and proposed actions of the protagonists. Finally, ‘moral’ is equivalent to ‘value’, highlighting the underlying principles or ethics driving the narrative.

In the NVBC framework, heroes embody the 'good' elements that the system should adopt or internalize, while villains symbolize the 'bad' elements it should reject or externalize. The clash between heroes and villains typically revolves around the defense or challenge of a core value. Each protagonist, whether hero or villain, is driven by specific desires and objectives, aiming to influence actions or behaviors in line with their goals. These conflicts, while focused, usually revolve around central issues, underscoring the narrative's key points of contention.

When coding the articles, if the main claims of the article were presented as neutral, the coder still has the discretion to ascribe ‘hero’ to a subject if that subject was promoted in a normative or prescriptive way indicating a quality of ‘what ought to be’ or ‘what is good’. The article titled “Regents Back 6 Charter Schools; Total is Now 33” found in Topic 40 is a good example of this scenario. This article presented information as if the facts were neutral. However, the value statements were implied. Specifically, the article advertised the features of charter schools that were ‘approved’ or ‘accepted’ by the state and offered them as exemplars by isolating them in this context.

Using NVBC to code articles and identify narrative elements from NPF helps reveal details of the institutional field. These details are not apparent in the topic model alone. Hand coding, however, is extremely time consuming and best serves as a method to identify aspects of the field the researcher would like to analyze in more fine-grained detail. For this reason, the use of hand-coding was limited to one theme: *Structural Components and Key Players*. Since this theme captured essential elements of the institution of K-12 public education, it is used as the example below. The topics grouped under the thematic heading, *Structural Components and Key Players,* are as follows:

Topic 29 (24) - Union / Political / Leaders
Topic 26 (7) - Teachers / Principals / Students (education/teaching)
Topic 25 (13) - School Board / Superintendent / School System
Topic 40 (15) - Charter / Program

Under the NVBC schema, the five most heavily weighted articles from each of the four aforementioned topics were subjected to an in-depth hand-coding process. This process adhered to identifying the following set of specific criteria within each article:

1. **Hero and Villain Identification**: Determine the entities or concepts portrayed as the 'hero' (positive force) and 'villain' (negative force) within the narrative.
2. **Desired Outcomes (Wants)**: Identify the outcomes or goals ('wants') articulated in the articles. These 'wants' may be attributed to specific individuals or groups, or they may be presented as general aspirations.
3. **Actions to Be Taken**: Note any actions suggested or advocated in the articles. These can range from specific steps proposed for particular entities to broader, more generalized recommendations.
4. **Values**: Ascertain the values underpinning the narrative, either explicitly stated or inferred indirectly from the context and content of the articles.

Table 8 displays how this information was systematically organized into a matrix format, providing a structured overview of the data.

Data Collection in Hand Coding Process

Issue	Hero	Villain	Want	Action to Take	Value
public school rewards workers who merely show up	NEA rebels (9,000 delegates) who stand up to "unsympathetic majority"	mediocre instructors holding students hostage	teachers who cling to the job security of the past to stop the resistance.	politicians, parents, business leaders calling on teachers to be held more accountable for student achievement	accountability - "teachers to be held accountable for student achievement"
automatic pay increase for teachers	alternative to public school "monopoly"	mediocre schools	provide teachers with more money	force merit pay (by school board's action)	competition - pay for performance, "merit pay"
the substitute teacher shortage locally and nationwide	pay for performance plans	public school "monopoly"	reduce demand for substitute teachers	take action against "resistance" of union	incentivizing teacher attendance with pay for remaining sick days
accountability in school mathematics education	Denver (as example of using merit pay with success)	clueless teachers union, NEA	"you may hold me [teacher] accountable when class size is cut in half"	ignore fear of solution (competition) creating problems of inequality growing between wealthy and poor schools, increasing the divisiveness among teachers, and lack of focus on low base salary that contributes to teacher shortage.	high quality mathematics education
accountability to congress for lowering class size	neutral (teachers seen in positive light)	neutral	"It is time to examine whether reducing class size is worth the price tag."	"At the end of the school year, pay them [teachers] for the days they were entitled to take off but didn't."	smaller class size
accountability to assure quality teachers	teachers	congress	remove principal for poor performance	don't reduce class size	high quality teachers
principal leaving inner city job to go to suburb where the work is easier and there is more pay.	high quality teachers	low quality teachers	offer more pay in exchange for increased freedom to remove mediocre principals	have high quality teachers	teachers - for what they are able to accomplish in poor conditions
principal shortage	talented principals who are defecting to the suburbs	inner city principal "job some describe as hell with tenure"	better starting salaries that do not "automatically increase regardless of how well or poorly a teacher does the job"	reduce Class Size	principal as manager
make district more competitive with surrounding school system during time of teacher shortage	the city : willing to grant much higher pay	a "stultifying union" (principal's union)		congress must mandate smaller class size	principal as vital job
	legislative efforts to remove tenure protections from state law	mediocre principals		abolish principal union	high-quality principals
	AB 1117 sponsored by Assemblyman Thomas Calderon (D-Montebello)	UTLA (union)		assure high quality principal	freedom to remove mediocre principal
	the "very best teachers"	union who "fight(s) performance-based salaries"		freedom to remove mediocre principal	attract better teachers with higher starting salaries

Table 8: Screenshot of a portion of the organized results table using the NVBC hand-coding process for Topic 26.

Table 8 displays a sample of the results organized from the hand-coding process using NVBC, as applied to Topic 26. For the complete data table, refer to Appendix G. A list of the top 5 most heavily weighted documents for each topic, used in the coding process, is available in the file within Appendix F. Table 8 shows the coding results of the

top 5 documents for Topic 25, Topic 26, Topic 29, and Topic 40. The table is structured into six columns, each representing a different element of the coding framework: Issue, Hero, Villain, Want, Action to Take, and Value.

To differentiate the results from each of the five articles within the topic, a color-coding system is used. Each color corresponds to one specific article with its coding results uniformly represented across the table. For instance, all cells colored in grey contain the coding results from the article from the *Los Angeles Times* titled 'Education / An Exploration of Ideas, Issues, and Trends in Education' (1998). This color-coded approach has been consistently applied to organize and display the hand-coding results for all topics within the *Structural Components and Key Players* theme.

The primary focus of the analysis was on the 'values' column of the coded data. For each topic, articles were grouped in a way that facilitated the assembly and examination of the values linked to their respective themes. This approach allowed for a more structured analysis, where values from similar themes could be compared and contrasted if needed. From this analysis, six primary categories of values emerged: Quality, Input, Accountability, Privatization, Curriculum/Programming, and Role/Job Description. Each statement in the 'values' column was carefully reviewed and assigned to one of these six categories based on its content.

Further, within these broad categories, subcategories became evident. For instance, in the *Input* category, two distinct subcategories emerged: 1) Including and Directing Input which pertains to how input is solicited or guided, and 2) Excluding Input which relates to efforts to limit or omit input in the process. A notable example of the *Input* category is

Topic 25: School Board, Superintendent/School System which frequently highlighted values concerning input. For instance, an article titled *The Politics of School Boundaries: Fairfax Board Studies Plan to Alter Controversial Process* (Benning, 1998) includes a relevant quote: “Public input is good, [but] he would not want to see the board bound to any community recommendations.”

This section presents a concise summary of the identified value categories, including descriptions of their respective subgroups and the total frequency of each category's mention in the coded data. The value categories reviewed below are as follows: Quality, Input, Accountability, Role or Job Description, Privatization, and Curriculum/Programming.

The *Quality* category, mentioned 27 times, encapsulates values related to high standards and desirable characteristics within the educational context. This value was typically identified through references to 'high quality' or specific desirable traits. The subgroups within this category provide insights into various aspects that define 'quality' in the educational sphere.

Here is a breakdown of the *Quality* subgroups along with the frequency of their mentions: board (8), board + PTA (1), school system (1), summer school (1), union (5), principal (2), reporter (1), teacher (6), math education (1), and class size (1).

Although 'quality' is frequently mentioned, the specifics of what constitutes 'high quality' are often not detailed, leaving the term open to interpretation. For example, phrases like 'high quality teacher' or 'high quality math education' were noted, but without explicit criteria, leaving readers to infer what 'high quality' entails in these contexts.

The *Input* category, referenced 27 times, focuses on the role of input in decision-making processes, particularly involving school boards. The analysis of the coded data reveals a general trend favoring the encouragement of input. However, there is a notable resistance, especially from board members to the extent of influence such input should have on decision-making.

The subcategories within *Input* reflect various expressions and attitudes towards the involvement of different stakeholders in the decision-making process. The breakdown of these subcategories, along with their mention counts, is as follows: public input to board (7), board unbound to input (1), limiting input from public to board (3), value board's opinion (5), PTA input to board (3), input from school staff to board (1), limiting input from PTA to board (1), and school board to not give input in administrative affairs and management decisions (2). These subcategories represent different perspectives on the degree and nature of input, ranging from actively seeking public and staff opinions to limiting or disregarding external input in board and administrative decisions.

In the *Accountability* category, with nine mentions, the value of responsibility is evident through statements that assign accountability to a particular party for certain outcomes or suggest shared responsibilities between parties. Interestingly, some subgroups are labeled with 'incentive' indicating that accountability in these instances is tied to potential rewards or incentives rather than being absolute.

The concept of accountability in these contexts is framed as one party being accountable to or for another. The breakdown of the subgroups, along with the number of mentions, includes the following: teachers for student achievement (2 mentions), merit pay

(1), relationship between PTA and school board (1), teachers for attendance (incentivized) (1), students for perfect summer school attendance (incentivized) (1), state and federal government's funding responsibilities for poor elementary schools and summer school (2), and private local funds supporting summer school (1). Each of these subgroups reflects a distinct aspect of accountability, ranging from teacher responsibilities for student outcomes to financial obligations of governmental and private entities towards educational initiatives.

The *Role or Job Description* category, mentioned 26 times, encompasses a range of expectations and norms about the functions and responsibilities of different entities within the educational sphere. This category spans from prescriptive statements, such as "unions ought to continue their democratic tradition", to prohibitive ones like "the board should not dictate the superintendent's retirement timing."

It also includes explicit value statements reflecting expectations or ideals, like in the quote "It's the job of the president to speak on behalf of the board. We asked him to do that, and he ignored us" (Banas, 1999) which implicitly suggests a value placed on board presidents who represent the board's voice. Additionally, this category captures perspectives on interpersonal treatment, exemplified by views on treating principals as managers or recognizing the principal's critical role.

The breakdown of subcategories with their respective total mentions is as follows: board (6), superintendent (1), principal (3), PTA (4), union (5), parents (1), summer school (4), students (1), teachers (1), and school system (1). This category reveals diverse expectations and perceptions about the roles and responsibilities of various stakeholders

in the educational system, from administrative leaders to students and teachers.

The *Privatization* category, appearing 13 times, captures values related to the privatization of public education. This category reflects a range of perspectives, encompassing both advocacy for and opposition to privatizing various elements and functions within the public education system.

The division within this category is evident in the subcategories, which show the count of mentions advocating for the opposing positions. These include the following: against privatizing public school management (2 mentions), against vouchers (2 mentions), and for charter schools (14 mentions). This classification highlights the ongoing debate and contrasting viewpoints regarding the role of privatization in the public education sector, from management aspects to the implementation of vouchers and charter schools.

In the *Curriculum / Programming* category, which was mentioned 7 times, the value statements are predominantly focused on specific programs and methods used in education, particularly within charter schools. A recurring theme in these value statements is the endorsement of adopting practices and curriculums like those used in charter schools. This broader value is reflected in more detailed suggestions on how to emulate these charter school approaches.

The subcategories within *Curriculum / Programming* reflect specific educational programs and methodologies that are valued, framed as 'we value this _____.' The breakdown of these subcategories, along with their mention counts includes: Beacon Lighthouse Curriculum used by charter schools (1 mention), Core Knowledge Curriculum

based on the work of ED Hirsch used in charter schools (1), phonic teaching methods employed in charter schools (1), summer programs (4 mentions), and year-round schooling (1 mention).

The examples here illustrate some of the many ways in which topic models and the NVBC schema support and extend our understanding of the institutional field. Topic models help us 'see' the landscape and NVBC schema along with close reading of select articles helps us understand what we see. Framed within the paradigm of complexity, identifying the values presented in the narrative provides insight into what the institutional field holds.

LDAvis: a two-dimensional landscape

LDAvis serves as a valuable tool during the exploratory phase of data analysis. Guided by LDAvis, Topic 48 (LDAvis number 25) was explored further. Topic 48, labeled 'NCLB', is part of the *Punctuating the Equilibrium* theme. The LDA Topic Model and LDAvis each assigns its own unique numbers to topics. For consistency, this research uses the LDA Topic Model number first, followed by the corresponding LDAvis number in parentheses.

The *Punctuating the Equilibrium* theme also encompasses other topics, which are as follows:

- Topic 27 (5): "American Values and National Interests"
- Topic 41 (20): "President Bush and His Campaign"
- Topic 45 (11): "Political Parties and Moving a Bill through Congress"
- Topic 31 (41) "NCLB Players".

LDAvis provides an array of interactive features for visualizing the relationships and interconnections among topics and topic words, focusing on visualizing connections both between and within topics. Initially, the NVBC is applied to identify value statements within articles. Once these values are identified, the next step involves integrating these value statements back into the broader topic model. This integration highlights the interconnectedness of these value statements across various topics, thereby creating a network-like structure of values and concepts within the model.

The landscape of the institutional field is fluid, dynamic, and emerges from these relationships between topics. Each topic is not a single, static feature of the landscape. Instead, each topic is an element that contributes to the landscape. The landscape is shaped by the values and the values are, in turn, shaped by the landscape. LDAvis offers a way to visualize these relationships.

Observing the dynamic interaction between topics in a topic model involves identifying points in the data landscape where these topics intersect or interact. One effective approach is to select topics that show a high degree of relation to specific value terms. The LDAvis tool is particularly useful in this context, as it visually reveals the relationships between topics. Further analysis of these interactions can then elucidate how these topics provide context and depth to the associated value terms.

This research includes a detailed walkthrough of the process used to select value terms for the exploratory phase, considering the research's limited scope. Only one value term was operationalized within the LDAvis graphic for a focused analysis.

Process for Selecting Value Terms to Investigate with LDAvis:

1. **Initial Selection from Coded Data**: The value terms were chosen from the hand-coded 'values' column, derived from a select group of articles analyzed using the NVBC schema. The focus was on value terms that could be succinctly represented by a single word, such as ‘accountability’, ‘quality’, ‘private’, ‘charter’, and ‘voucher’.
2. **Searching and Graphing Terms**: Python was utilized to search the topic word list (outputted as a .csv file from the LDA topic model found in Appendix F) for these selected value terms. Each term and the topics most associated with it were then graphed to visualize their relationships (see Figures 38-40). This step was instrumental in guiding the selection of specific terms for the subsequent sentiment analysis.
3. **Analysis of Term Frequency and Normalization**: The top 10 topics in the corpus, based on their normalized weight, were selected. For each of these top 10 topics, the top 25 most heavily weighted words were selected. The top 30 words of all topics were analyzed for occurrences of these words. The list of words appearing in Table 9 are the words that appear more than once among the top 30 words for all topics. Each word in this list is accompanied by the count of how many times it appears and the specific topic numbers where it appears.
4. **Adjusting for Data Scale and Relevance**: Considering the dataset's size and the small, normalized weights, Figure 38 displays the value terms chosen from the hand coded data on a logarithmic scale, making differences in smaller values more noticeable. To further refine the focus, a threshold was set at the 90th percentile for each term. The analysis and plotting were limited to topics where a term's weight exceeded this threshold, ensuring concentration on the most relevant data.

Key Terms in Top Ten Weighted Topics

Word	Count	Topics
education	20	[0, 2, 3, 6, 13, 17, 18, 20, 25, 26, 29, 33, 34, 39, 40, 41, 43, 45, 47, 48]
community	11	[0, 5, 7, 11, 15, 17, 25, 34, 35, 39, 46]
officials	10	[4, 8, 13, 18, 23, 24, 25, 34, 35, 46]
work	8	[2, 5, 15, 22, 26, 27, 30, 36]
plan	7	[4, 13, 25, 41, 43, 46, 48]
council	5	[0, 12, 13, 25, 29]
american	5	[7, 9, 16, 27, 30]
government	8	[1, 4, 16, 20, 22, 27, 38, 48]
group	5	[5, 22, 28, 29, 33]
issues	4	[21, 27, 39, 41]
good	4	[26, 27, 36, 47]
need	3	[2, 26, 27]
pay	4	[20, 22, 26, 43]
principal	4	[26, 31, 40, 47]
life	3	[27, 30, 36]
union	2	[26, 29]
america	2	[16, 27]
private	2	[3, 22]
industry	2	[22, 42]
great	2	[27, 30]
companies	2	[22, 42]
training	3	[2, 15, 26]

Table 9: This table presents a list of words most frequently appearing in the ten most heavily weighted topics in the corpus. The Count column provides the total number of topics where the term appears more than once. And the Topics column lists the specific topic numbers where each term appears (listed in the 'Topics' column).

Distribution of Key Value Terms across Topics

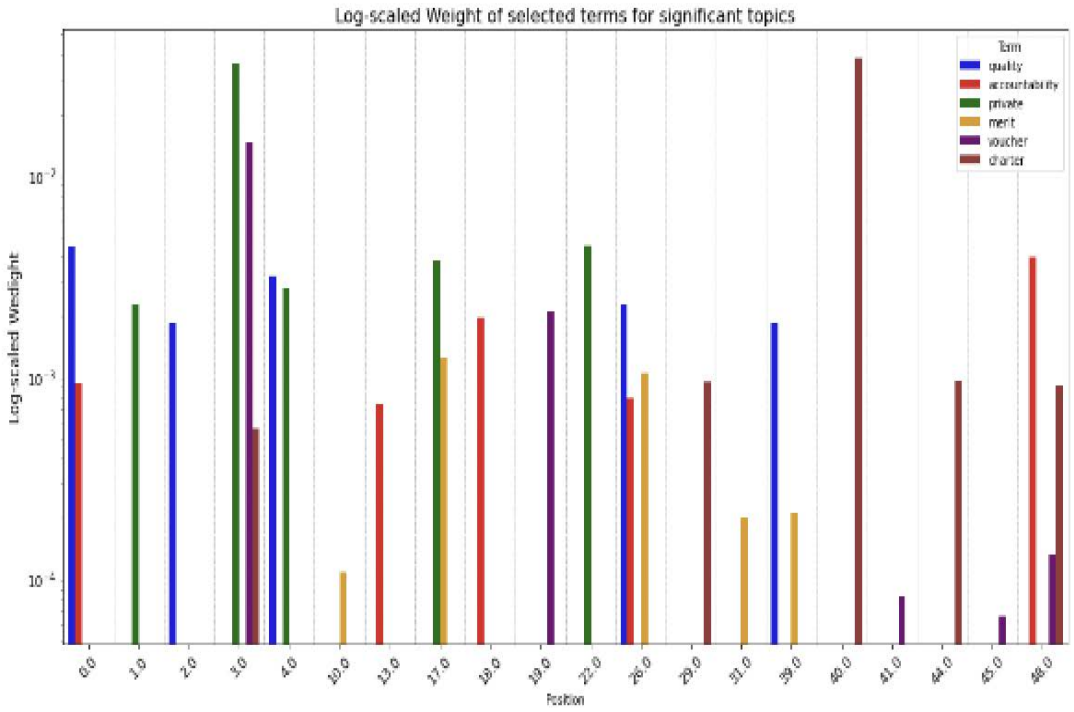

Figure 38: Bar chart showcasing the six value terms identified during the hand-coding process, each represented by a different color: ‘quality’ (blue), ‘accountability’ (red), ‘private’ (green), ‘merit’ (yellow), ‘voucher’ (purple), and ‘charter’ (brown). The x-axis displays the topic numbers associated with these terms, focusing only on topics where these terms are present.

Figure 39 offers an in-depth analysis of the distribution of the term 'accountability' across different topics. This bar chart specifically illustrates the weight of 'accountability' in each relevant topic. The y-axis, labeled ‘Weight for Accountability’, presents the non-normalized weight of the term, reflecting the total number of times ‘accountability’ is mentioned within each topic. This frequency-based measure indicates the prominence of the term in each topic. Notably, Topic 18 stands out in the chart (Figure 39) as having the highest weight for ‘accountability’, followed by Topic 48, with Topics 26 and 13 also showing significant mentions.

Distribution of 'Accountability' Across Topics

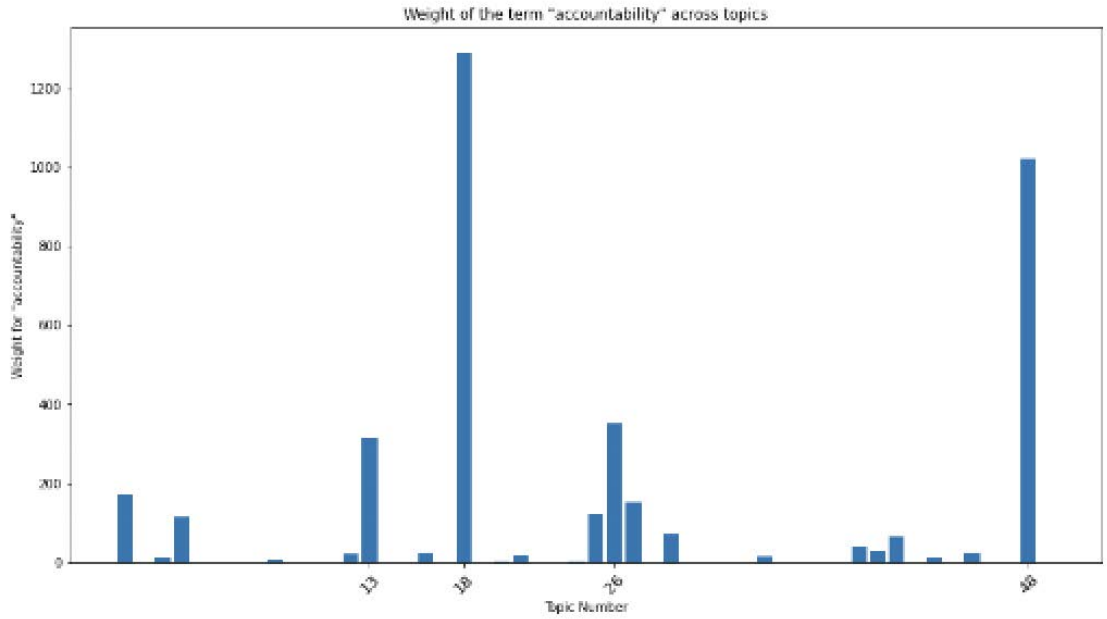

Figure 39: Bar chart displaying the weight of the term “accountability” across topics. The x-axis displays the topic numbers for all topics where the term weight exceeds a value of 200. The y-axis is the raw weight of the term (not normalized).

Topics with Highest Weights for 'Accountability’

	Topic Number	accountability
18	18	1289.259615
48	48	1022.211854
26	26	351.686105
13	13	312.702374

Table 10: Table displays the topic number where the term ‘accountability’ is most heavily weighted and the weight of the word within that topic. The graph shows only topics where ‘accountability’ is weighted above 200.

Table 10 focuses on the distribution of the term 'accountability' across various topics. It specifically lists the topics where 'accountability' has the highest weights. In the

'Accountability' column, the values indicate the term's weight within each topic, effectively representing the frequency or 'sheer volume of mentions' of 'accountability' in that topic. The table only includes topics where 'accountability' has a weight of 200 or more.

Figure 39 and Table 10 show the topics that are most heavily associated with the term ‘accountability’. To provide more context, the following is a list of the 5 most heavily weighted topics for the term ‘accountability’ along with their topic labels and the associated theme:

Topic 18

‘Test/Scores/Percent/Standards’ with Theme: *Pushed Narrative*

Topic 48

‘NCLB’ with Theme: Punctuating the Equilibrium

Topic 26

‘Teachers/ Principals / Students/ with Theme: *Structural Components and Key Players*

Topic 13

‘Mayor/Education/Chancellor/Control’ with Theme: *Local Reflections*

Figure 40 and Table 11 provide a focused overview of the topics that are most prominently associated with the term 'quality'. Unlike 'accountability', which is linked to fewer topics, 'quality' appears across a broader range. However, for a more detailed and concentrated analysis, this study specifically examines the top three topics where 'quality' has the highest weights.

The three most heavily weighted topics for 'quality', along with their respective labels and themes, are as follows:

Topic 26

‘Teachers/Principals/Students’ with Theme: *Structural Components and Key Players*

Topic 0 title and theme not assigned

Topic 4 title and theme not assigned

Notably, Topics 0 and 4 were not assigned specific themes during the initial phase of sorting and labeling. Given the particular interest in these topics, a more in-depth analysis was conducted for Topic 0. This involved a dedicated topic model analysis of the articles most closely associated with Topic 0 to uncover the nuances and context of 'quality' within this topic.

The articles associated with Topic 0 were filtered out of the original dataset. The Topic 0 corpus was created from all articles that had a weight greater than or equal to 0.005. The corpus size for Topic 0 is 3904 articles, and the topic model was set to generate 50 topics. Because this portion of analysis is focused on using the LDAvis visualization, this research will not elaborate on the variety of results produced from the topic model using the Topic 0 corpus. However, LDAvis will be used to further explore the results of the LDA topic model (see Appendix I for the LDAvis files). For improved clarity, this research will refer to Topic 0 as the “Quality Topic” in order to avoid the ambiguous numeric naming convention.

Distribution of 'Quality' Across Topics

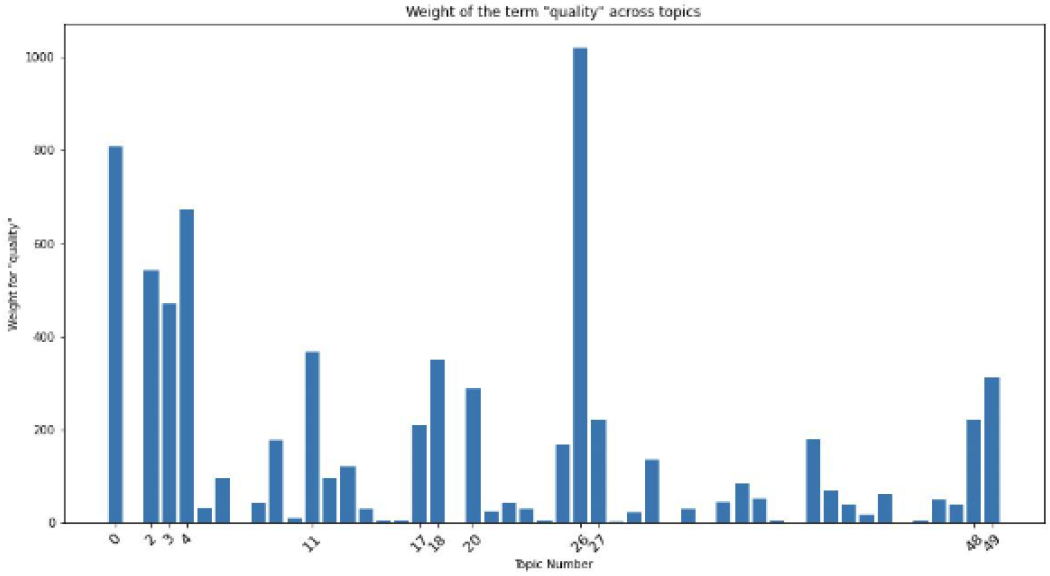

Figure 40: This bar chart displays the weight of the term "quality" across topics. The x-axis displays the topic numbers for all topics where the term weight exceeds a value of 200. The y-axis is the raw weight of the term (not normalized).

Topics with Highest Weights for 'Quality'

	Topic Number	quality
26	26	1020.578067
0	0	807.119432
4	4	672.910974
2	2	541.497357
3	3	469.883140
11	11	366.521615
18	18	350.826875
49	49	312.312862
20	20	289.239013
48	48	221.733707
27	27	221.223137
17	17	210.162827

Table 11: This table displays the topic number where the term 'quality' is most heavily weighted. The values that appear in the 'quality' column represent the weight of the word within the topic. These are the topics with values above 200.

In examining the topic distribution within the LDAvis graphic, the left side of the display reveals a well-balanced model. This is characterized by an even distribution of topic sizes and their proximity to one another, indicating topic similarity. On the right side, the graphic highlights the top 30 most salient terms in the corpus. These key terms provide insight into the dominant themes of the dataset and include words such as school, district, chicago, county, charter, students, million, closed, teacher, state, library, tax, board, education, edison, and more.

LDAvis Landscape for Topic 0

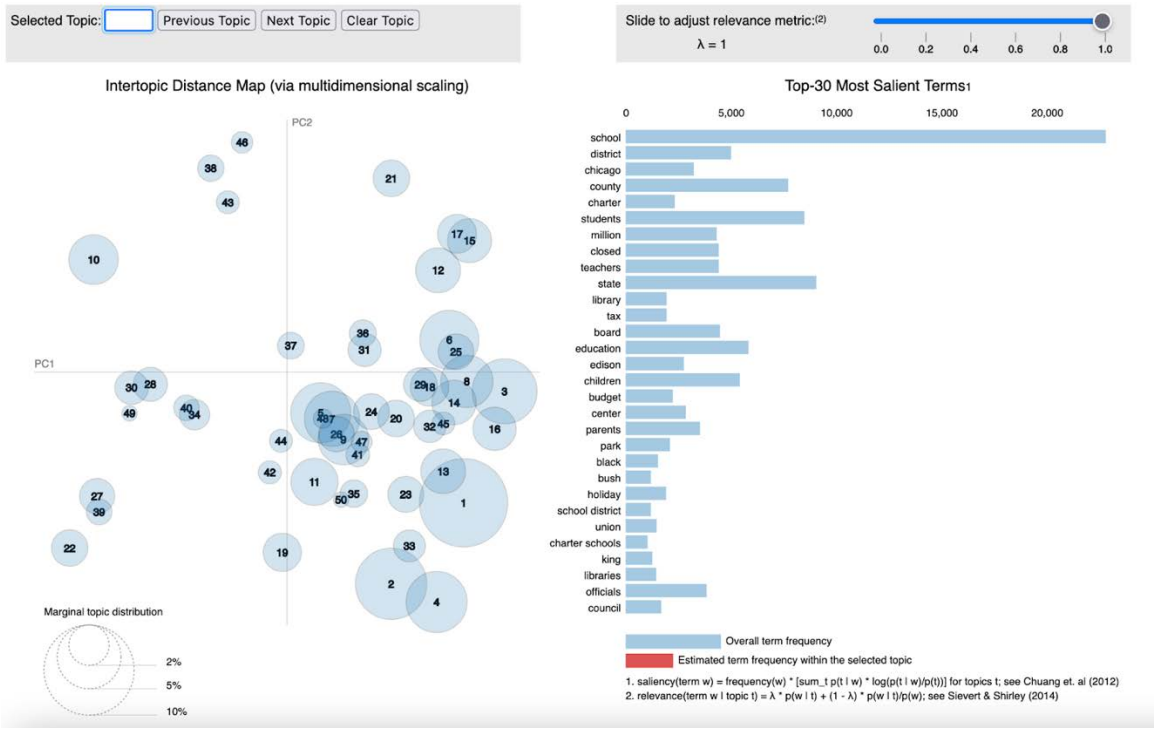

Figure 41: Screenshot of 'Quality' Topic Model (Topic 0) using LDAvis.

The exploration of the 'Quality' topic model reveals that Topic 1 has the most significant marginal topic distribution. This topic is part of a cluster within the intertopic distance map, prompting a closer examination of its content. The analysis will focus on

the top relevant terms in Topic 1 and investigate its relationships with other topics through these terms.

The primary objective here is to delve into the data for exploratory purposes. This case serves as a practical example to demonstrate how a value term, once identified within the topics, can be further examined through a targeted topic modeling approach. Essentially, this process creates a specific topic model for a single topic (in this case, 'Quality Topic / Topic 0') within the larger corpus.

Particularly noteworthy in Figure 38 are Topics 18 and 26 which emerged as highly weighted in both the 'accountability' and 'quality' contexts. A more in-depth analysis of these topics could uncover detailed insights about the associated value statements. While similar topic models were generated for Topics 18 and 26, the findings from these specific models are not included in this study due to its limited scope.

LDAvis is utilized to deepen the understanding of the identified 'value' terms, especially in terms of their meaning, intensity, and dynamics during the period of NCLB. LDAvis is a key tool in this initial exploratory phase due to its ability to explore the relationships and structure of topics within the LDA model. It provides valuable insights into the composition of topics and how key terms are distributed across these topics. It should be noted that LDAvis primarily offers a snapshot of these relationships rather than tracking their evolution over time. The visualization could be configured to show change over time, but since the topics are graphed over time, this research omitted this step.

In addition, this exploration represents just one facet of a broader analytical process. Further investigation could involve steps such as grouping topics into themes, conducting

close readings using the NVBC schema, analyzing topic model graphs over time, and performing sentiment analysis.

Figure 42 showcases Topic 1 within the 'Quality' topic model, selected for its prominence as it holds the largest marginal topic distribution. This topic is also part of a larger cluster, indicating its strong connection to multiple other topics. Among the top 30 relevant terms in Topic 1, key terms such as 'school', 'students', 'teachers', 'high', 'education', and 'children' stand out. These terms are prevalent within the subset of articles that specifically address the concept of 'quality' in the Topic 0 corpus.

LDAvis 'Quality' Topic Model:
Emphasizing Topic 1 as the Most Dominant Topic in the Corpus

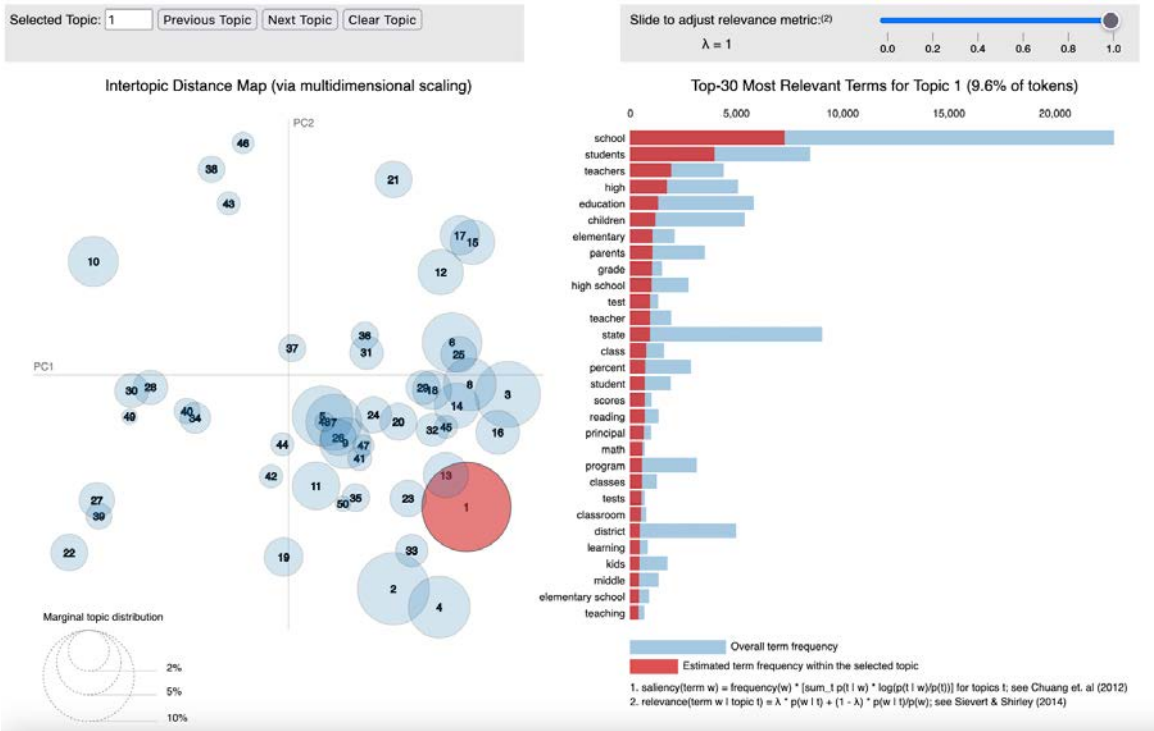

Figure 42 is a screenshot of Topic 1 within the 'Quality' Topic Model. Topic

Consequently, the dominant topic in this refined corpus revolves around aspects of 'quality' in relation to various educational elements like schools, testing, teachers, principals, reading, and mathematics. However, while many terms in this list are commonly used in general educational discourse, a more insightful approach would be to identify terms uniquely or predominantly associated with Topic 1. Such specific terms can shed more light on the distinctive aspects of 'quality' pertaining to the educational context such as schools, students, and teachers, as mentioned in the list. Figure 43 provides information about Topic 1 within the 'Quality' topic model.

LDAvis 'Quality' Topic Model: Emphasizing Topic 1 most relevant terms

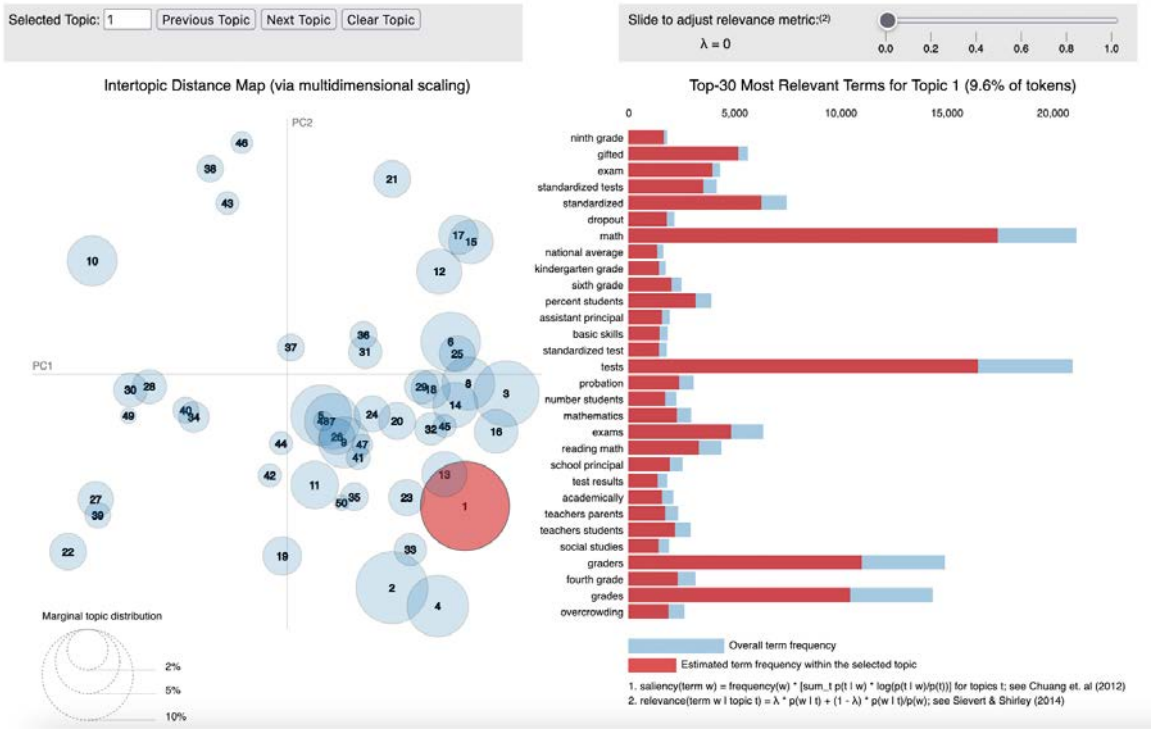

Figure 43: Screenshot of Topic 1 within the 'Quality' Topic Model displayed in LDAvis. This graphic displays the same data as Figure 46 except the "relevance metric" is set to 0.0 which means that the terms that are most heavily weighted to Topic 1, specifically, are displayed. The red bar shows their weight relative to Topic 1 and the blue bar shows their weight relative to the corpus as a whole. Because of this, the list of words is re-ordered and new words appear.

Figure 43 presents the same LDAvis visualization as the previous figure but with a key difference: the relevance metric has been set to 0. This adjustment shifts the focus to terms that are most strongly associated with Topic 1 within the 'Quality' corpus, meaning that these terms appear in the discourse of Topic 1 but not in other topics. Notably, the term 'ninth grade' emerges as the most significant term, almost exclusively linked to this topic. This is followed by terms like 'gifted', 'eighth', 'standardized tests', 'standardize', and 'dropout', ranked according to their relative prominence in Topic 1 as opposed to other topics.

LDAvis 'Quality' Topic Model:
Emphasizing topics most relevant to terms 'standardized test'

Figure 44: Screenshot of the Topic 1 within the 'Quality' Topic Model using LDAvis. This graphic displays the same data as Figure 41 except the words "standardized test" was hovered over and the topics that are most heavily related to that term appear as colored circles on the map.

This adjustment to the LDAvis setting really hones in on what is unique about Topic 1 in the ‘Quality’ conversation. The list of terms predominantly associated with Topic 1 offers a clearer understanding of the specific aspects and contexts in which the concept of 'quality' is being discussed within the educational discourse.

Given that Topic 1 is the most heavily weighted topic in the 'Quality' topic model, its strong association with terms like 'standardization', 'testing', 'scores', 'math', and 'reading' is not unexpected. To further explore this, the relationship of the term 'standardized test' with the topics in this model was observed. Figure 44 illustrates this relationship, confirming that Topic 1 is indeed the most heavily weighted topic for 'standardized tests'. Additionally, this term is also a significant component in Topics 3 and 18.

This visualization is facilitated by the interactive capabilities of LDAvis that provides detailed information when users hover over different elements. When the term 'standardized tests' is highlighted, the related topics are emphasized on the Intertopic Distance Map. In this instance, Topic 1 is marked in red and its bubble size increases, signifying its substantial link with 'standardized test'. Furthermore, Topics 18 and 3 also emerge as related to this term. Interestingly, 'standardized tests' shows a strong connection with only three topics (1, 3, and 18), indicating that it is not a prominent term across other topics in this corpus.

Figures 45 and 46 aim to delve into the specific content of Topics 3 and 18. Topics 3 and 18 are part of the corpus heavily centered around the theme of 'quality' within the educational discourse. By adjusting the 'relevance metric' to 0.0 in the LDAvis

visualization, the focus is placed on the words most relevant to these individual topics, revealing their unique contribution to the overarching theme.

Topic 18, while not contributing a large portion to the overall corpus, plays a significant role in the context of 'quality', particularly when viewed in relation to other topics in its cluster on the Intertopic Distance Map. The Top 30 Most Relevant Terms for Topic 18 include terms such as 'charters', 'charter school', and 'school choice'. These terms indicate a focus on charter schools and alternative educational models, offering insights into one aspect of the 'quality' discourse, specifically how different school structures and choices are perceived in terms of quality.

Similarly, Topic 3, accounting for a substantial 5% of the overall corpus, underscores its importance in the discussion of 'quality'. Positioned amidst a cluster of related topics, its top 30 most relevant terms like 'school chancellor', 'privatization', and 'school reform' point to themes of school administration, governance, and reform initiatives. This suggests that aspects such as leadership, management, and policy changes are integral to the discourse on 'quality' in education.

In summary, the exploration of these terms in Topics 3 and 18 using LDAvis not only highlights their specific thematic focuses but also aligns these topics within the broader narrative of 'quality' in education. This analysis offers a nuanced understanding of how various elements, from school types to administrative policies, contribute to the ongoing conversation about quality in the educational sector.

This analytical approach, applied to a large dataset, provides an overarching view of the dominant themes and terms. However, to fully grasp the depth and nuances of how

these ideas are expressed and understood in the educational discourse, a close reading of the actual articles and narratives is essential. Such a detailed examination of the texts will complement the findings of the topic model, offering a more complete and rich understanding of the discourse on 'quality' in education.

The content of these topics helps explain what is being discussed in the narrative of ‘quality’ as it pertains to the institutional field of American K-12 public education during the period of NCLB reform. Within the visualization of the institutional field, these topics are the signals that are being captured in the narrative. Specifically, these models show us that the value of ‘quality’ is being discussed in a variety of ways.

LDAvis ‘Quality’ Topic Model: Emphasizing Topic 18’s most relevant to terms

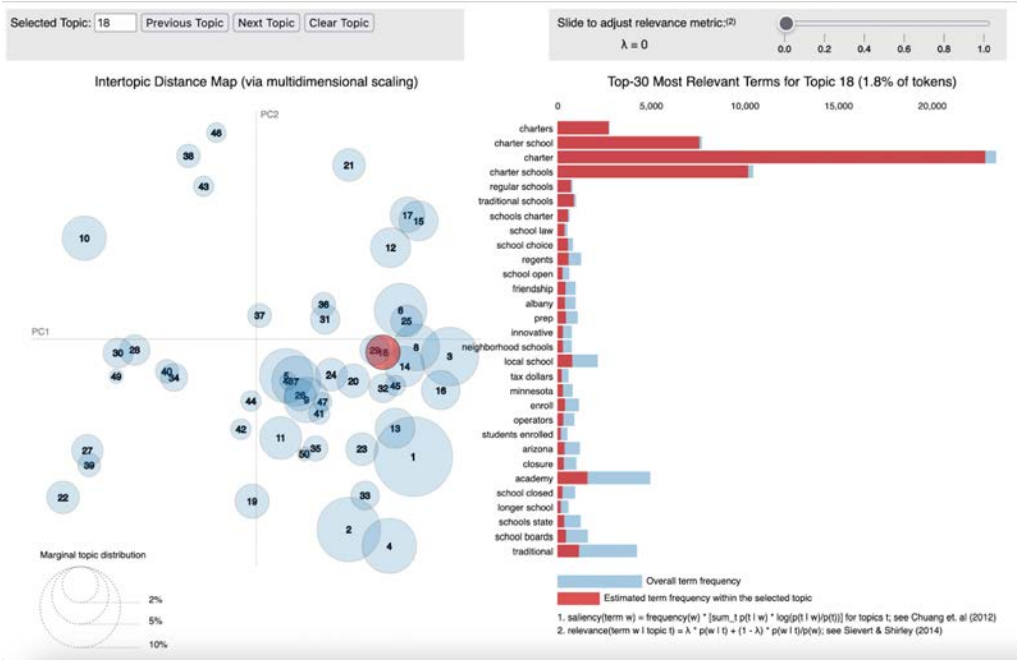

Figure 45: Screenshot of Topic 18 (red circle) within the ‘Quality’ Topic Model using LDAvis. The “relevance metric” is set to 0.0 displaying the words that are most relevant to Topic 18.

LDAvis 'Quality' Topic Model: Emphasizing Topic 3's most relevant to terms

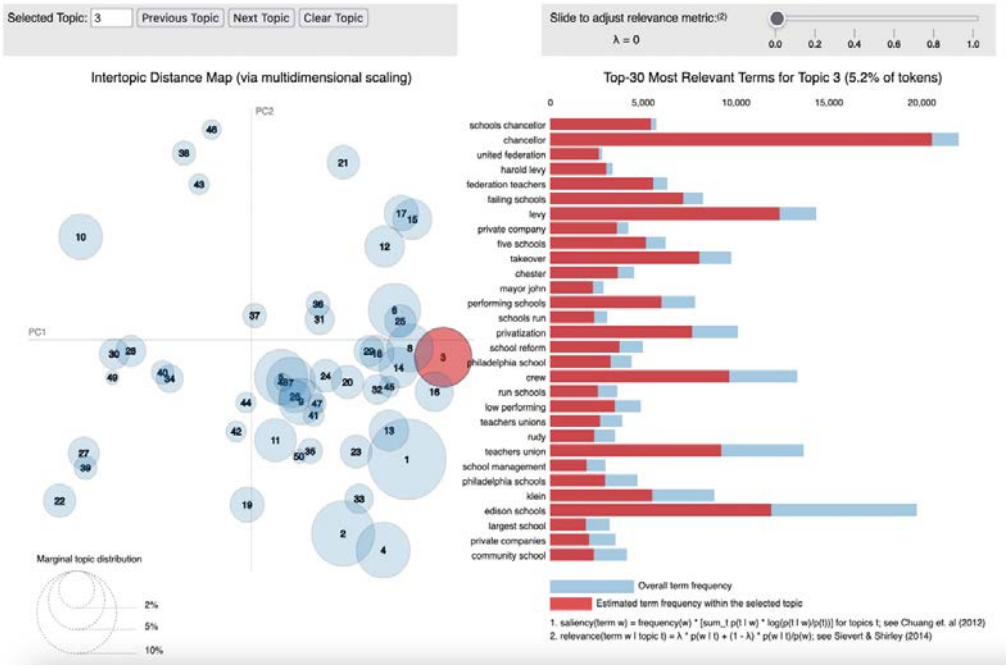

Figure 46: Screenshot of Topic 3 (red circle) within the 'Quality' Topic Model. The "relevance metric" is set to 0.0 displaying the words that are most relevant to Topic 3.

The computer-generated models and the results of human hand coding have revealed features of the institutional field understood through adaptive institutional topology theory. Using these results, it can be known, empirically, what are some of the classifiers (values-rules) in the system and some of the signals being processed in the field. Modelers can start to see the 'physical' makeup of the field and what the field is disposed to do as quasi-intentional behavior.

From the viewpoint of the observer, the landscape is beginning to fill out with these value spaces. Now, the question becomes, how is the field functioning? What is it disposed to do? For that, this research goes beyond the signals collected in topic models and understood through NVBC schema. The next step uses sentiment analysis along with a

close read of the text to expose the texture and directionality of the landforms on the dynamic landscape. Sentiment analysis will help shed light on the behaviors within the field and the directionality of those values, exposing which values are vying for prominence and legitimacy. The sentiment models use the full dataset of the corpus of 37,186 articles.

Finding the subject of the sentiment analysis:

In this phase of the research, the focus is on pinpointing specific areas of interest for further investigation. Transitioning from topic modeling to sentiment analysis involves crucial decisions about selecting terms for in-depth analysis. The selection process depends on the researcher's ability to identify the most relevant terms. The researcher's expertise in the content area, combined with insights gathered from the topic model, guides the narrowing of the research focus and aids in choosing the most pertinent term(s) for analysis. Careful selection is essential for ensuring that the sentiment analysis aligns effectively with the research objectives.

The sentiment analysis model utilized in this research incorporates a two-pronged approach to term selection. Initially, the model is configured to generate a list of entities from the raw data, providing a basis for selecting words or entities for further analysis (see list in the Appendix E). This list is not restrictive; the model is also equipped with a 'search' function that allows for the analysis of any term irrespective of its presence in the entity list. This flexibility ensures that the analysis is not confined to just the entities identified initially.

It's important to note that researchers have the option to generate a list of named entities from the text using various tools and libraries, such as ‘nltk’s Named Entity

Recognition or ‘spaCy’s Stanford’s Named Entity Recognizer. Such tools can be particularly beneficial in the exploratory phase of research, offering lists of entities categorized by types like 'GPE' (Geopolitical Entity), 'Person', and 'Organization'. This process of entity identification can aid in pinpointing relevant terms for in-depth sentiment analysis.

Topics Associated with Repeated Terms in Top Ten Weighted Topics

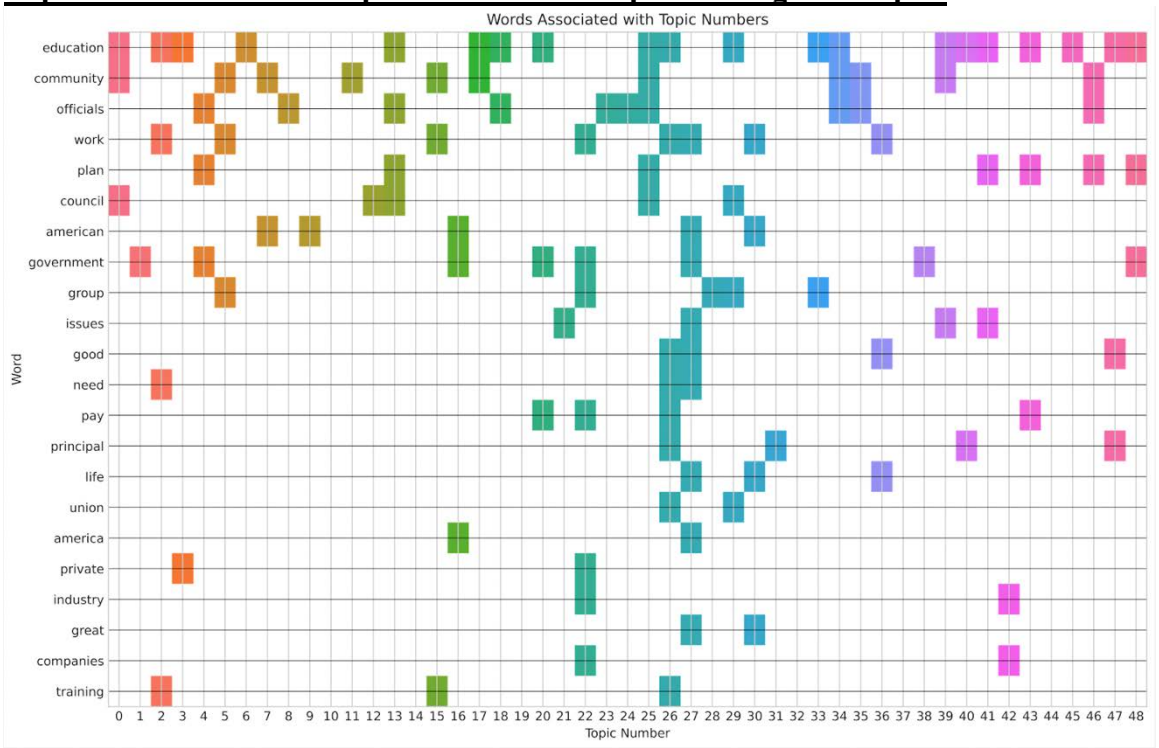

Figure 47: Chart showing terms in the corpus that appear more than once in the 10 most heavily weighted topics within the corpus and the topic numbers where those terms appear.

Beyond the list of entities produced by the sentiment analysis model, additional steps were taken to investigate the words appearing within the corpus. Leveraging the results from the topic model, two key documents were generated to aid in selecting terms for further analysis. The first step involved sorting the terms that appeared more than once across the ten most heavily weighted topics. Each term was associated with its

corresponding topic number to facilitate a deeper exploration of the topics or themes with which these words were most connected in the corpus. Table 9 presents a curated selection of this data, while Figure 47 offers a visual representation of these terms distributed across the topics.

From the generated list, potential terms were identified for in-depth analysis. The terms selected for analysis included 'education', 'education system', 'principal', 'superintendent', 'board', 'parent teacher association', 'union', 'private', 'standard', 'standardized', 'voucher', 'charter', and 'gates'. The analysis was not confined to single-word searches, allowing for the inclusion of related phrases like 'merit pay and performance pay' and plural forms of nouns, such as 'teacher, teachers, educator, educators'. The specific terms utilized in each analysis are detailed in the titles of the sentiment analysis graphs.

The selected terms for analysis underwent sentiment evaluation within the corpus, resulting in a series of graphs that illustrate their changing sentiment over time. These graphs can be found in the Appendix H, with a selection included in this paper (refer to Figures 48-61 below). The featured graphs highlight specific attributes that are considered significant in identifying and understanding shifts and trends within the field.

Figure 48 examines the term 'education', displaying a cumulative total of 9481 positive and negative sentences. The y-axis represents the normalized sentiment value labeled as 'total sum' to differentiate from other graphs where sentiment normalization varies. In this graph, the blue line indicates positive sentiments while the orange line shows negative sentiments.

The x-axis spans from January 1, 1998, to December 31, 2004, with intervals

marked in six-month increments. Data is aggregated monthly, providing a detailed temporal view of sentiment changes. Key historical moments are highlighted with faint yellow lines, marking the period from the passage to the initial implementation of NCLB.

Sentiment Analysis for 'Education'

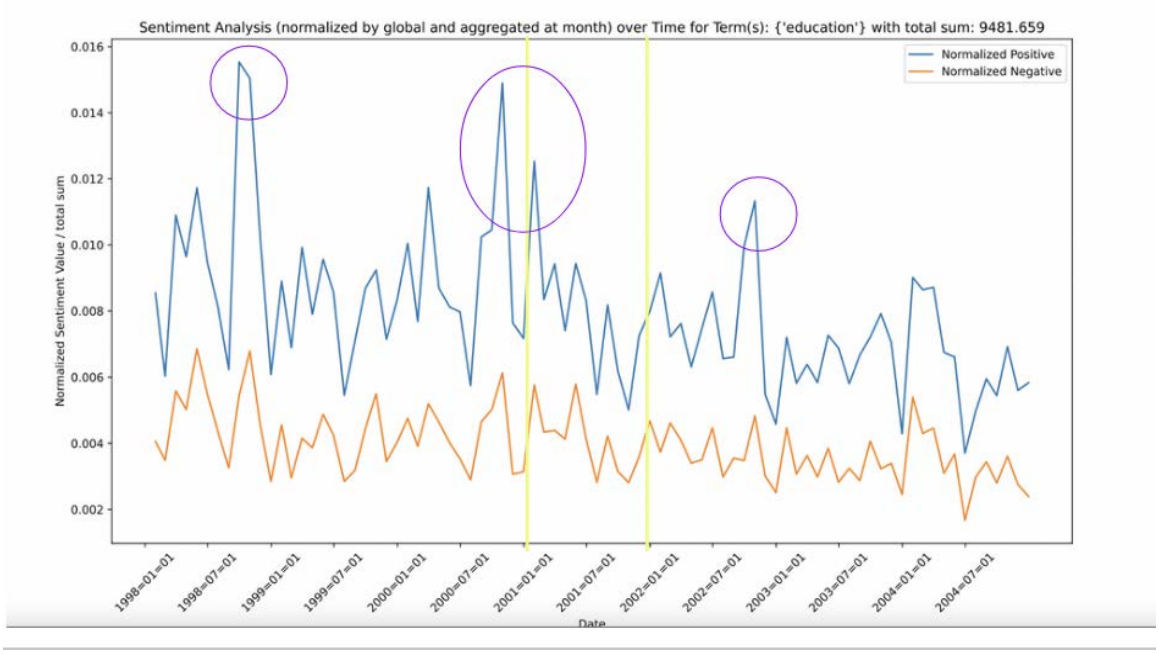

Figure 48: This graph displays the positive and negative sentiment values for the term "education" over the period of Jan. 1, 1998 - Dec. 31 2004. The y-axis displays the normalized sentiment value. The x-axis displays the date range from January 1, 1998 to December 31, 2004. This graph highlights 3 spikes in the data circled in purple. The yellow bars indicate the period of NCLB's passage and start of its implementation.

Normalization in this graph, referred to as 'normalized by global', calculates the proportion of positive or negative sentiment relative to the overall detected sentiment for 'education'. This approach emphasizes the intensity or prevalence of sentiments during the period. The 'total sum' serves as the denominator in this normalization process. Additionally, the time-series data is resampled at a monthly frequency, meaning it is organized into monthly segments (or 'bins') and the sentiments (both positive and negative)

are summed up for each month.

An analysis of the graph in Figure 48 reveals that while negative sentiment around education remained relatively stable, positive sentiment showed a notable decline over time. This trend is punctuated by significant spikes in positive sentiment, suggesting periods of heightened interest or discussion. However, these spikes gradually diminish, both in frequency and intensity, indicating a shift towards more stable or fixed sentiments about education.

The overall pattern suggests that the value or perception of education within the discourse became more established, leading to less fluctuating discussion intensity. The graph also shows an interesting relationship between positive and negative sentiments: they often appear nearly synchronized to each other. This suggests that discussions about education frequently involve a mix of both positive and negative perspectives. Notable changes in this pattern could signify significant disturbances or shifts in the field of education. These observed patterns and their implications present hypotheses that warrant further investigation in subsequent research.

In Figure 49, the observed decline in sentiment value over time in this large dataset suggests a shift in how people are talking about the subject. They are either saying fewer good things which would show up in the data as a drop in the count of total positive sentences or their positive comments are becoming less intense which will appear in the data as lower positive sentiment scores. Therefore, a key question arises from the trend lines in Figure 49: Is the observed decline in sentiment value attributable to a decrease in the number of sentiment-expressing sentences, or does it reflect a reduction in the intensity

of sentiments expressed, despite a fairly constant number of sentences?

Sentiment Analysis for 'Teacher / Educator'

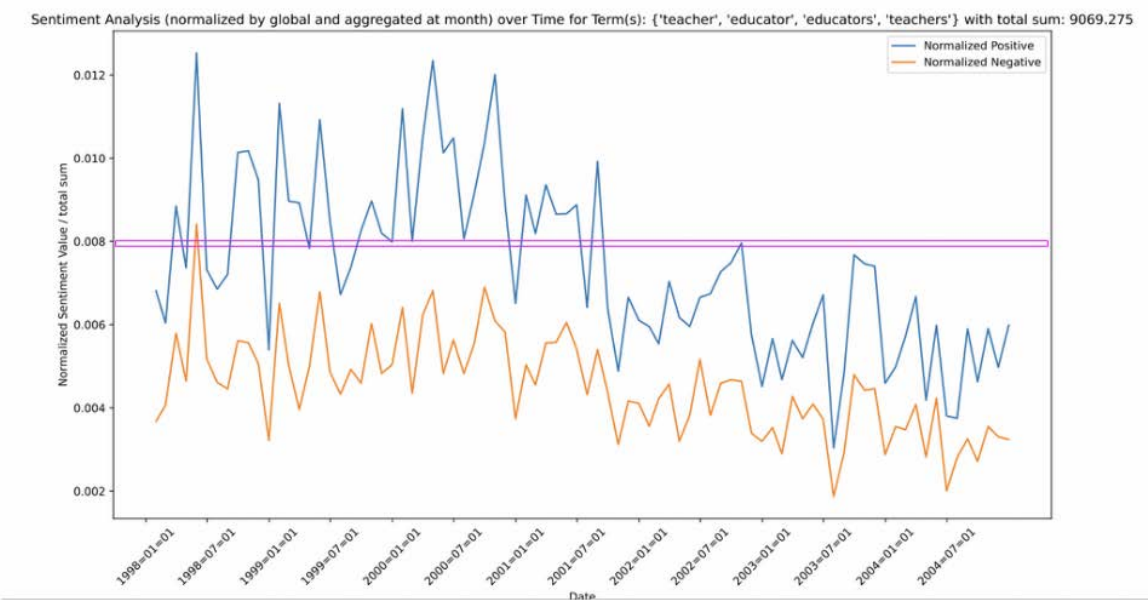

Figure 49: This graph displays the positive and negative sentiment values for the terms "teacher, educator, educators, and teachers" over the period of Jan. 1, 1998 - Dec. 31, 2004. The pink bar is provided as a visual aid to see the change over time.

The answer to this question becomes clearer upon examining the bar chart in Figure 50. This chart presents the absolute counts of sentences, both positive (in blue) and negative (in orange), aggregated monthly, that express sentiments about education. It reflects the downward trend seen in Figure 49's sentiment value. However, the decline in the absolute number of sentences expressing positive sentiments is not as pronounced as the decrease in their sentiment value. This subtle difference suggests that although there is a slight reduction in the volume of positive sentiments about education, the intensity or vigor of these sentiments has diminished more significantly. Such a trend points to a lessening focus and a subtle shift towards reduced positivity in the discourse about

education.

Positive and Negative Sentiment Trends in 'education' Sentences

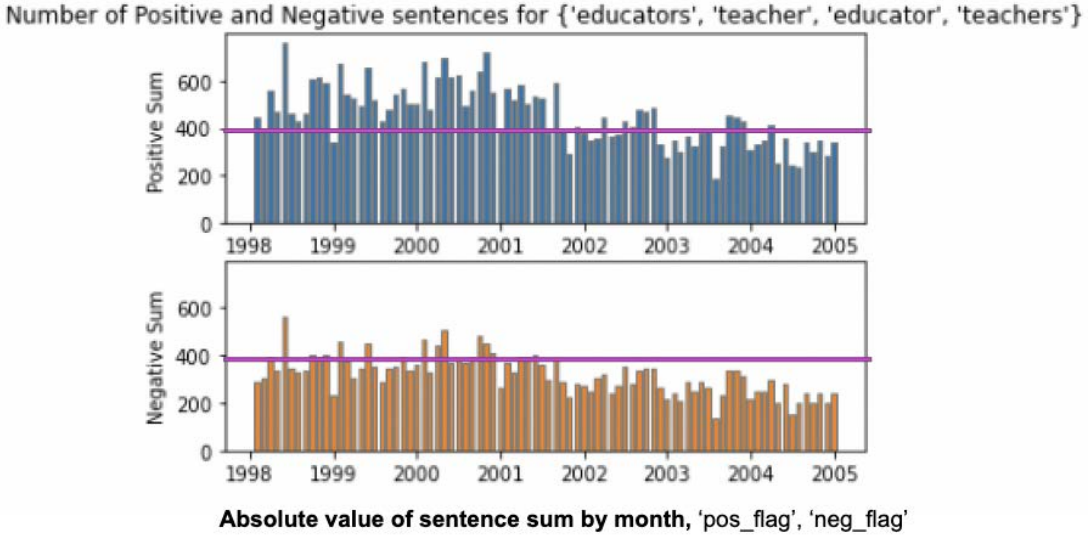

Figure 50: Bar chart showing the number of positive and negative sentences for the terms 'educators, teacher, educators, and teachers' over the period of Jan 1, 1998 – Dec. 31, 2004. The bars represent a monthly aggregation of sentiment values. The sentiment values in this bar chart are calculated as the absolute value (0 or 1) of sentiment (positive or negative) within a sentence. The pink bars are provided as a visual aid to see the change over time.

The number of positive sentences decreasing indicates that there is less favorable talk or reporting about public education in the media. This could be due to fewer positive developments to report on or a general shift in media focus towards other issues. The total of negative sentences remained a bit more stable but also showed decline over time. This decline implies that there is less criticism or fewer concerns raised about public education. This could mean that there were improvements in the system or a shift in media focus away from the negative aspects or the topic in general. A close read of the articles would provide the necessary details to fully understand the trends shown on the graphs. In essence, tracking these changes helps one understand how the conversation about public education is evolving in the media: whether it's becoming more positive, more negative, or shifting

in focus.

Sentiment Analysis for 'Principal'

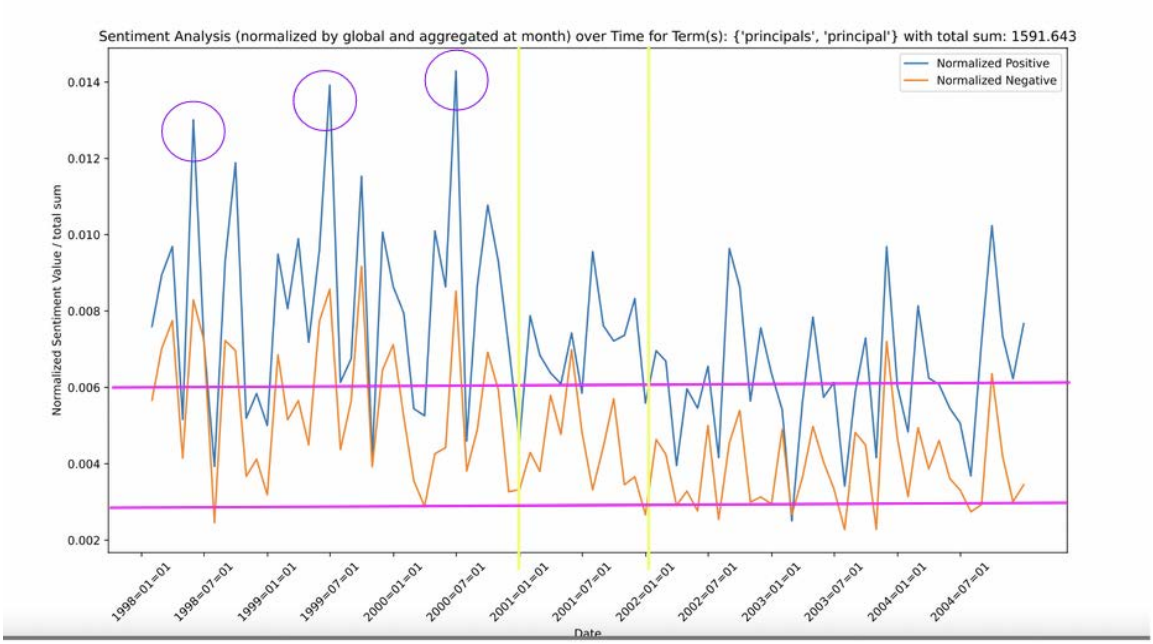

Figure 51: This graph displays the positive and negative sentiment values for the terms "principal and principals" over the period of Jan. 1, 1998 - Dec. 31, 2004. This graph highlights 3 spikes in the data circled in purple. The yellow bars indicate the period of NCLB's passage and initial implementation. The pink bars are provided as a visual aid to see the change over time.

The next two graphs shown in Figures 51 and 52 present the sentiment analysis for the terms 'principal' and 'principals'. As outlined previously, the hand coding revealed numerous mentions of principals and the value statements attributed to their position. For instance, the value statements highlighted the principal as a vital job and as a manager. The privatization value statements included discussions about privatizing public school management and the freedom to remove mediocre principals. In addition, there were value statements about attracting and hiring quality principals.

These graphs (Figure 51 and Figure 52) tell the researcher more about the content of those discussions in terms of their sentiment. Starting with Figure 51 and focusing on the 'peaks' of the trend line, three positive peaks appear in the discourse prior to NCLB followed by a noticeable decrease in overall positive sentiment. The negative sentiment, in contrast, remains fairly stable with a general decrease in intensity that begins in the period of NCLB's implementation and follows throughout the rest of the time represented in the graph.

Figure 51 introduces the peak, a distinct and important feature in reading a sentiment analysis graph for the purpose of visualizing the institutional field. The peaks in positive sentiment represent the value associated with principal that are entering the field. These values may be novel in which case they are creating new basins or they may be reinforcing the legitimacy of basins that previously existed within the field. Either way, the spikes in sentiment align with the adaptive institutional topology theory and how the data is operationalized.

A brief review of Figure 52 reminds the reader that signals with a positive value convert behavior into action which, in this case, tend toward legitimizing the notion of principal and the associated values. These positive value statements are distinctive in how they are represented in the landscape, as basins. In this instance, as shown in Figure 51, the three positive spikes prior to NCLB followed by a lowered positive, yet more stable sentiment, suggests that the values associated with these positive spikes were absorbed by the field due to the fact that they entered into a basin and do not appear to be contested after their last spike.

Topographical Features of the Institutional Field

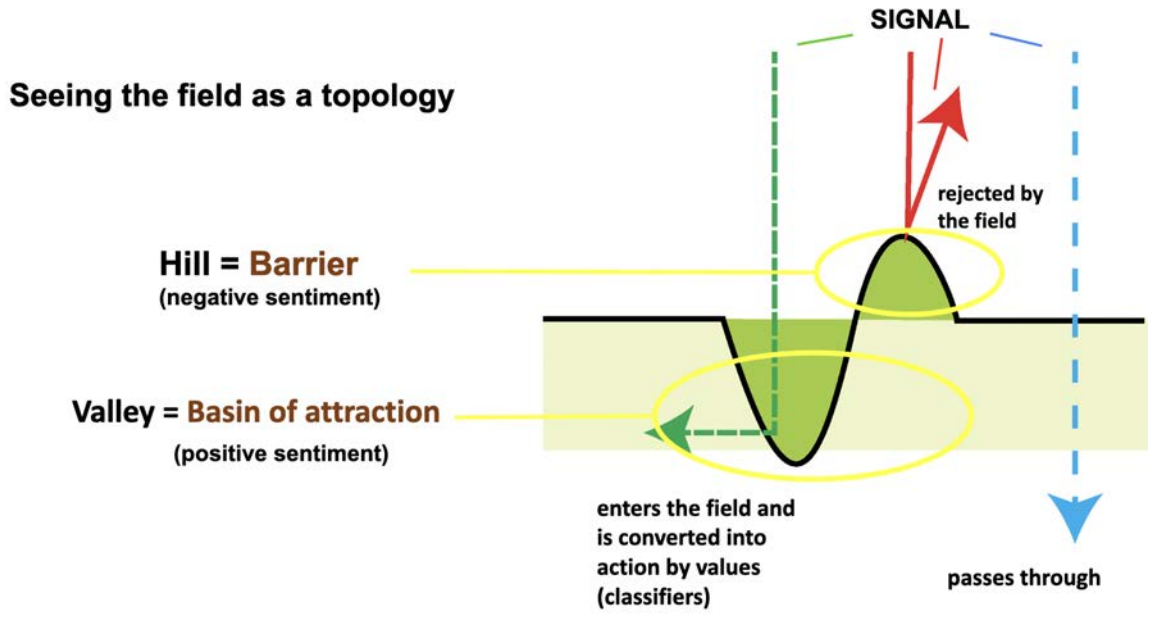

Figure 52: Illustration of a two-dimensional view of the institutional field and the topographical features created by the behavior of the signal.

Figure 51 is used to illustrate features of positive peaks and how they translate into field level behavior as displayed in a visualization of the field. Basins provide insight into the values that are demonstrating stability. Sampling some of the articles found in these basins over a span of time would indicate what topics and values are generally stable or accepted by the field, as well as what environmental conditions appear as neutral and yet relevant enough to include in the narrative. This hypothesis is not being tested here.

Figure 53 shows the number of sentences holding positive and negative sentiment for the term ‘principal’ and ‘principals.’ This graph is included so that the amount of conversation dedicated to ‘principals’ can be observed. An in-depth analysis of this graph is not included here. However, the graph helps paint a more complete picture of the trends

in the discourse and the intensity or quantity of sentiment being communicated in the corpus of 37,186 articles.

Positive and Negative Sentence Trends in 'principal' Sentences

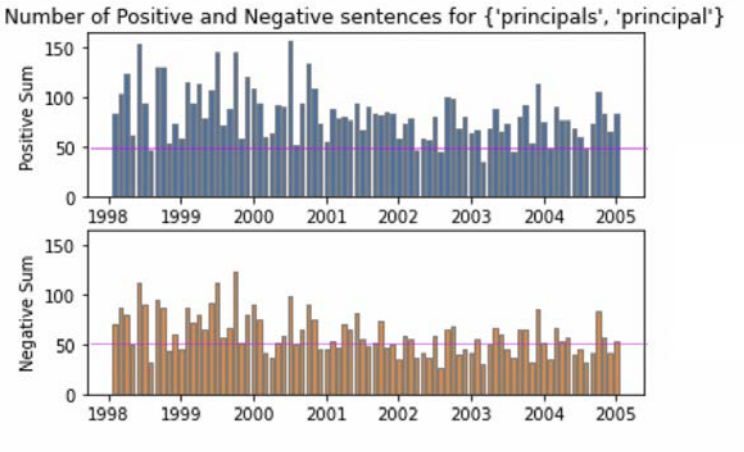

Figure 53: This is a bar chart showing the number of positive and negative sentences for the terms 'principal and principals' over the period of Jan 1, 1998 – Dec. 31, 2004. The bars represent a monthly aggregation of sentiment values. The sentiment values in this bar chart are calculated as the absolute value (0 or 1) of sentiment (positive or negative) within a sentence. The pink bars are provided as a visual aid to see the change over time.

Figures 54 and 55 analyze the sentiment related to terms such as 'school boards', 'school board', 'board', and 'boards'. A notable feature in these figures is the pattern of the positive and negative sentiment trend lines. Throughout most of the time period analyzed, these trend lines rise and fall in a corresponding manner, indicating a synchronized relationship in the intensity or frequency of both positive and negative sentiments about school boards. This synchronized pattern is distinct from the observations in the 'education' graph (Figure 48) and the 'teacher' graph (Figure 49). In those cases, although the trends showed a similar pattern, the difference between the positive and negative sentiment values was more pronounced, showing a clearer separation between the sentiments.

Sentiment Analysis for 'School Board'

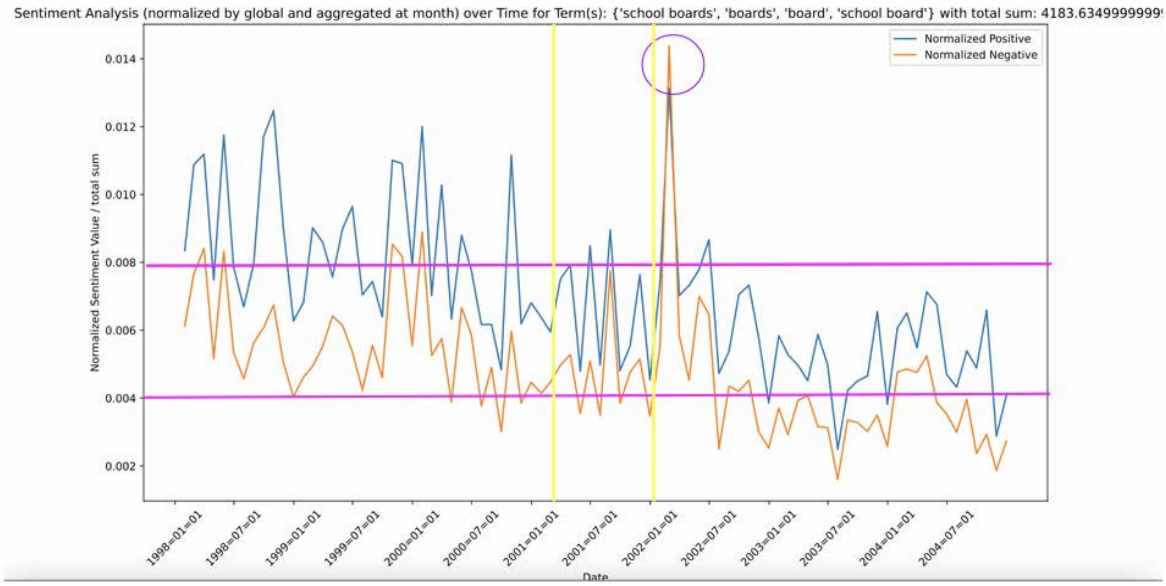

Figure 54: This graph displays the positive and negative sentiment values for the terms "school boards, school board, board, and boards" over the period of Jan. 1, 1998 - Dec. 31, 2004. This graph highlights a spike in the data circled in purple. The yellow bars indicate the period of NCLB's passage and initial implementation. The pink bars are provided as a visual aid to see the change over time.

Positive and Negative Sentence Trends in 'school board' Sentences

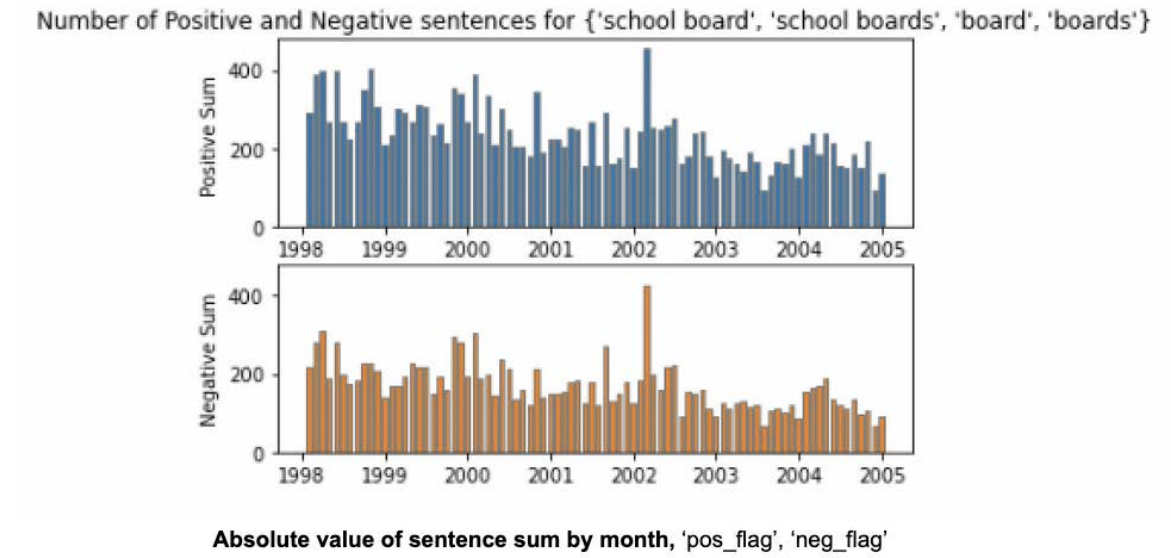

Figure 55: This is a bar chart shows the number of positive and negative sentences for the terms 'school board, school boards, board, and boards' over the period of Jan 1, 1998 – Dec. 31, 2004. The bars represent a monthly aggregation of sentiment values and are calculated as the absolute value (0 or 1) of sentiment (positive or negative) within a sentence.

Landscape of Competing Values

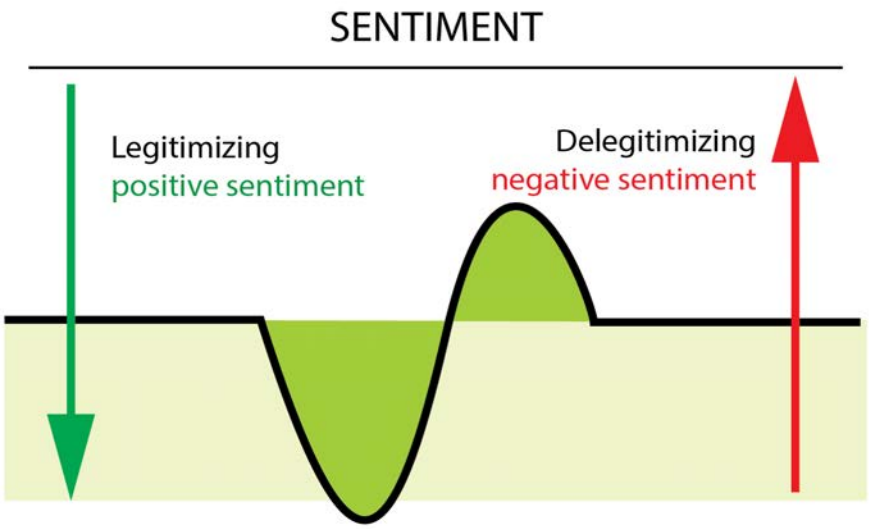

Figure 56: Graphic illustration describing the behavior of positive and negative values within the institutional field**.**

Part One of this research introduces the concept of field-level dynamics, where a field either internalizes or externalizes signals. When a signal encounters a field, there are two primary possible outcomes. The signal may pass through the field unaffected, leaving the signal invisible to the field. Alternatively, the signal may enter the field and trigger a classifier, which directs the signal's impact based on the nature of the sentiment.

As shown in Figure 56, in this context, negative sentiment plays a role in destabilizing or challenging the existing positive sentiment. It can exert an upward force, either pushing against and undermining the existing positive sentiment or creating a 'hill' or 'barrier' illustrated in the visualization. This action represents the field's effort to externalize or reject certain signals.

On the other hand, as shown in Figure 56, positive sentiment contributes to the stabilization or further legitimization of the existing basins in the field. It can also forge new basins or exert downward pressure on the 'hills' created by negative sentiment. This process works to transform barriers into new basins, facilitating the internalization of signals within the field.

To review the field level dynamics described in Part One, the field is either internalizing or externalizing a signal. When a signal encounters a field, the signal either passes through the field with the field or the signal enters the field and is directed by the classifier as to whether it produces upward pushing forces arising out of the negative sentiment or downward pushing forces arising out of the positive sentiment. Negative sentiment either destabilizes the existing positive sentiment, pushing up on it or delegitimizing it or the negative sentiment pushes up on the landscape to build a hill or a barrier, identifying signals that the field works to externalize. Positive sentiment either stabilizes or further legitimizes the already existing basins, creates new basins, or pushes down on the externalizing hills with the effect of working to change the hill from being a barrier to being a new basin for signal to be processed within the field.

The interplay of positive and negative sentiments is crucial in determining whether a signal gets internalized or externalized. If positive sentiment effectively counters the forces of externalization, a signal previously rejected by the field may be successfully internalized. If negative sentiment effectively destabilizes and “flattens” a basin once holding legitimizing positive sentiment, either a new basin is formed, an existing basin is expanded to include the territory of the previous basin, or an externalizing hill emerges.

While these concepts appear highly theoretical and therefore may seem removed from practical application, that is not the case. The ability to visualize the field to see what is actually there takes us from the realm of theory to the realm of practice. Part Four of this research expands on the implications of these dynamic behaviors within the field. Knowing what values the field has institutionalized and understanding what signals the field is processing, leaders and decision makers can influence these factors and drive change within an institutional field by putting this information to use.

The next three figures, Figures 57 to 59, present a selection of sentiment analysis graphs produced in this research, serving as illustrative examples. These graphs are included to demonstrate the dynamic nature of changing sentiments within educational discourse and the potential for further investigation by researchers. Specifically:

Figure 57 illustrates the sentiment analysis for the term ‘vouchers’.

Figure 58 displays the analysis for ‘charter’.

Figure 59 focuses on the sentiment around ‘performance pay, pay for performance, and merit pay’.

Each of these graphs tells its own story and acts as a springboard for generating new research questions. To uncover the answers to these questions, a detailed examination, or close reading, of the corresponding articles is necessary. The sentiment analysis conducted on ‘standards’ (Figure 60) and ‘benchmarks’ (Figure 61) provide a concise case study of how this investigative process can be applied.

Sentiment Analysis for 'Voucher'

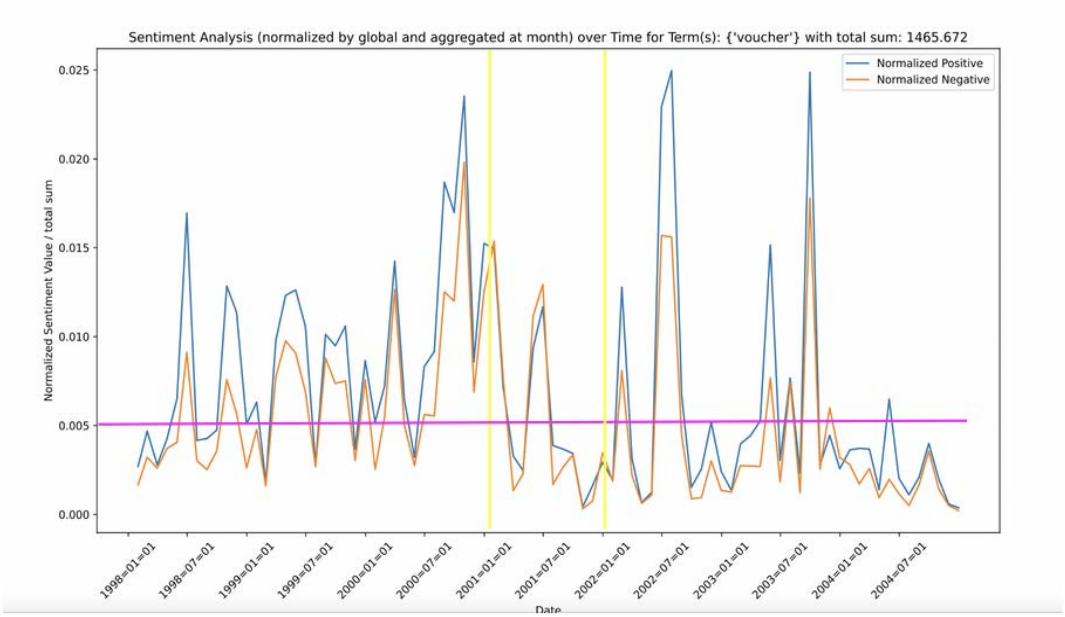

Figure 57: This graph displays the positive and negative sentiment values for the terms "Parent Teacher Association, PTA, parent teacher association, and pta" over the period of Jan. 1, 1998 - Dec. 31, 2004. The yellow bars indicate the period of NCLB's passage and initial implementation. The pink bars are provided as a visual aid to see the change over time.

Sentiment Analysis for 'Charter'

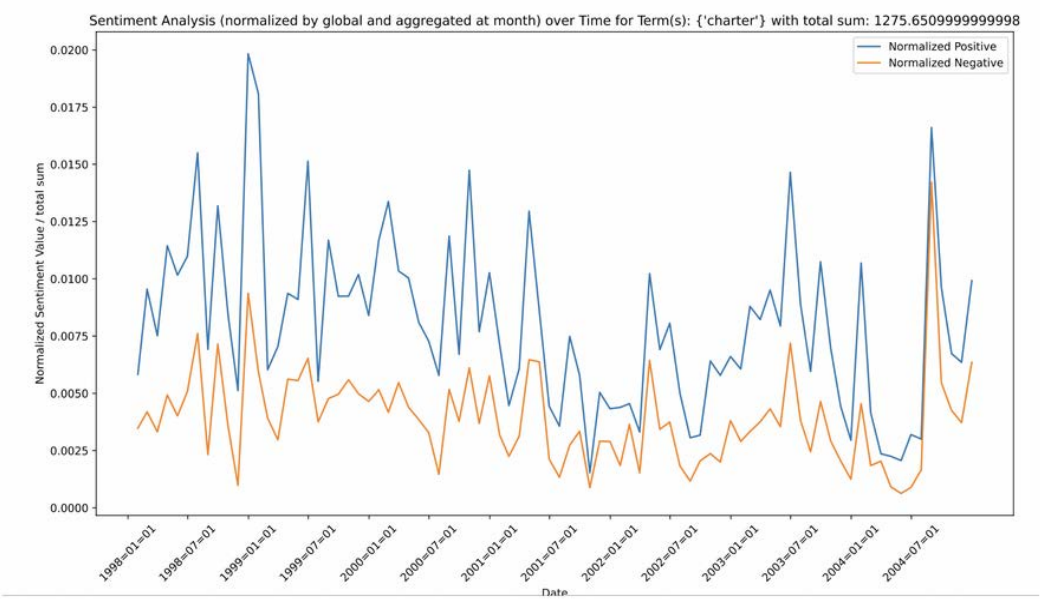

Figure 58: This graph displays the positive and negative sentiment values for the term "charter" over the period of Jan. 1, 1998 - Dec. 31, 2004.

Sentiment Analysis for 'Performance Pay / Merit Pay'

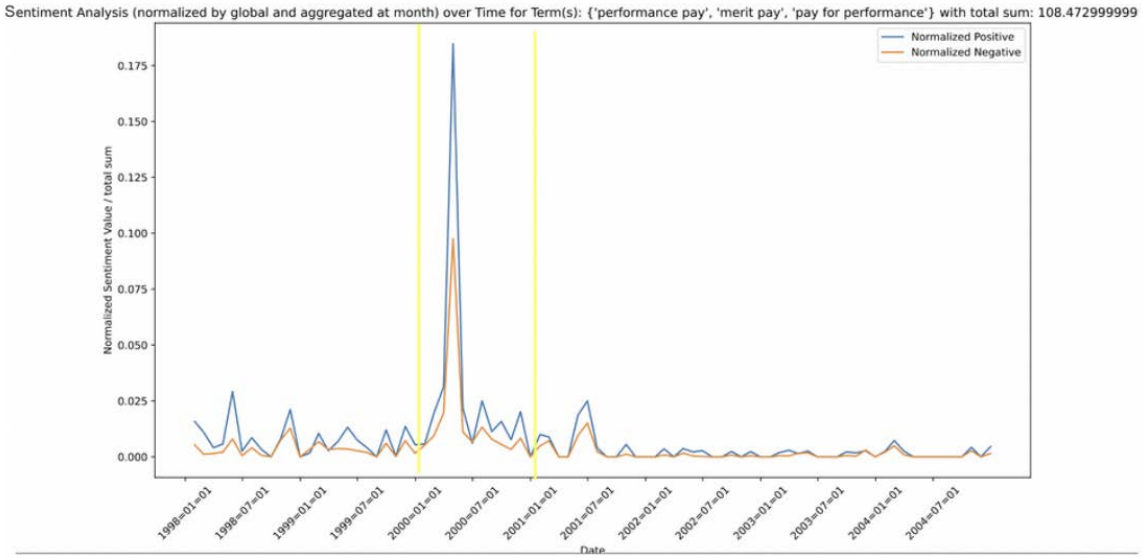

Figure 59: This graph displays the positive and negative sentiment values for the terms "performance pay, pay for performance, and merit pay" over the period of Jan. 1, 1998 - Dec. 31, 2004. The yellow bars indicate the period of NCLB's passage and initial implementation.

Sentiment Analysis for 'Standards'

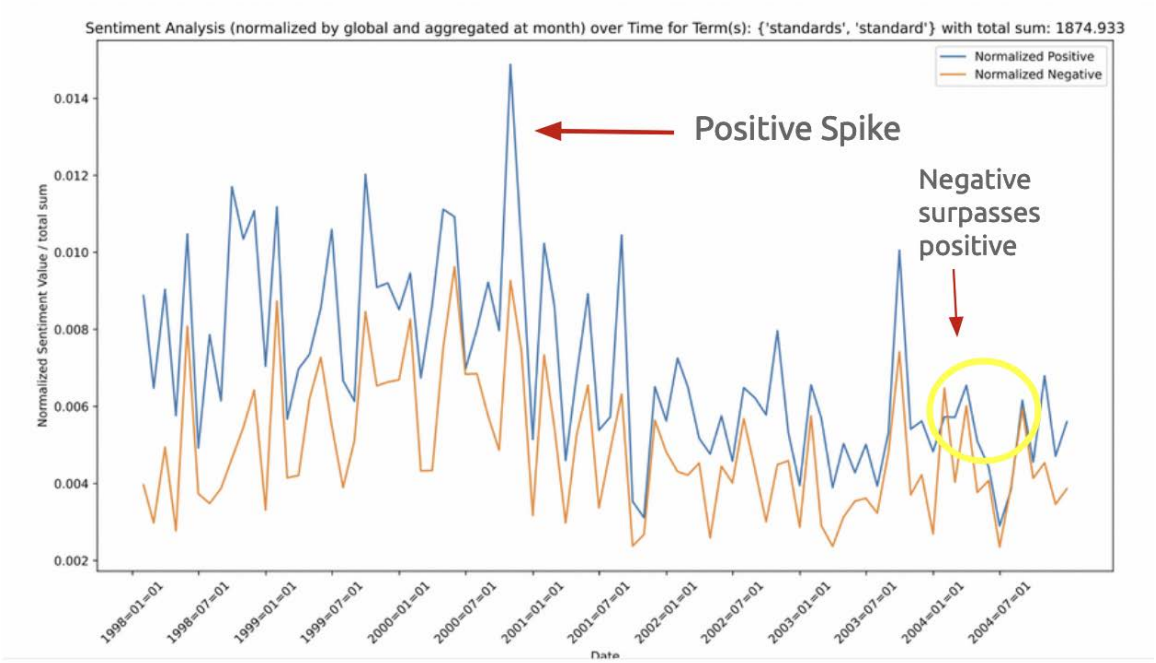

Figure 60: This graph displays the positive and negative sentiment values for the terms "standard and standards" over the period of Jan. 1, 1998 - Dec. 31, 2004. The sentiment values were normalized based on the sum of the positive values and negative values for the searched term.

Reviewing the graph in Figure 60 of the sentiment analysis for the terms ‘standards’ and ‘standard’, it is easy to identify a large spike in the positive sentiment occurring during the adoption phase of NCLB. Furthermore, starting in the year 2004, the negative sentiment value surpassed the positive sentiment value. This is something of significance given the previous patterns where positive sentiment consistently holds a higher value than negative sentiment. This dramatic shift in sentiment required a moment to reflect on that time period and the events that were happening on the ground.

An examination of the sentiment analysis graph in Figure 60, which focuses on the terms 'standards' and 'standard', highlights a notable trend. A significant spike in positive sentiment is clearly visible during the adoption phase of NCLB. Moreover, starting from 2004, there is a marked change: the negative sentiment value begins to exceed the positive sentiment value. This shift is particularly noteworthy considering the earlier trend from previous figures where positive sentiment consistently maintained a higher value than negative sentiment. This pronounced change in sentiment patterns calls for a pause to consider the events and circumstances of that time period, reflecting on what was transpiring in the education field during those years.

In 2004, while teaching in a middle school classroom in Portland, Oregon, and as a parent of children in Portland Public Schools, I gained an insider’s perspective on the education system of that time. These experiences provided valuable context for this research, particularly in understanding the nuances of the education system during the implementation of NCLB. This research relies on human interpretation and the application of contextual knowledge to model-generated data.

Drawing on my background as an educator, I understand that NCLB framed 'standards' in terms of 'benchmarks'. This insight led me to explore the sentiment analysis for the term 'benchmark'. The analysis presented in Figure 61 examines the sentiment associated with 'benchmarks' providing additional perspectives on the issues highlighted by the 'standards' sentiment analysis. This further exploration into 'benchmarks' not only complements the findings from the 'standards' analysis but also potentially offers deeper insights. By examining the similarities between the two graphs, researchers can better understand the interaction of the values tied to these concepts ('standards' and 'benchmark') within the complex landscape of the educational field.

Sentiment Analysis for 'Benchmarks'

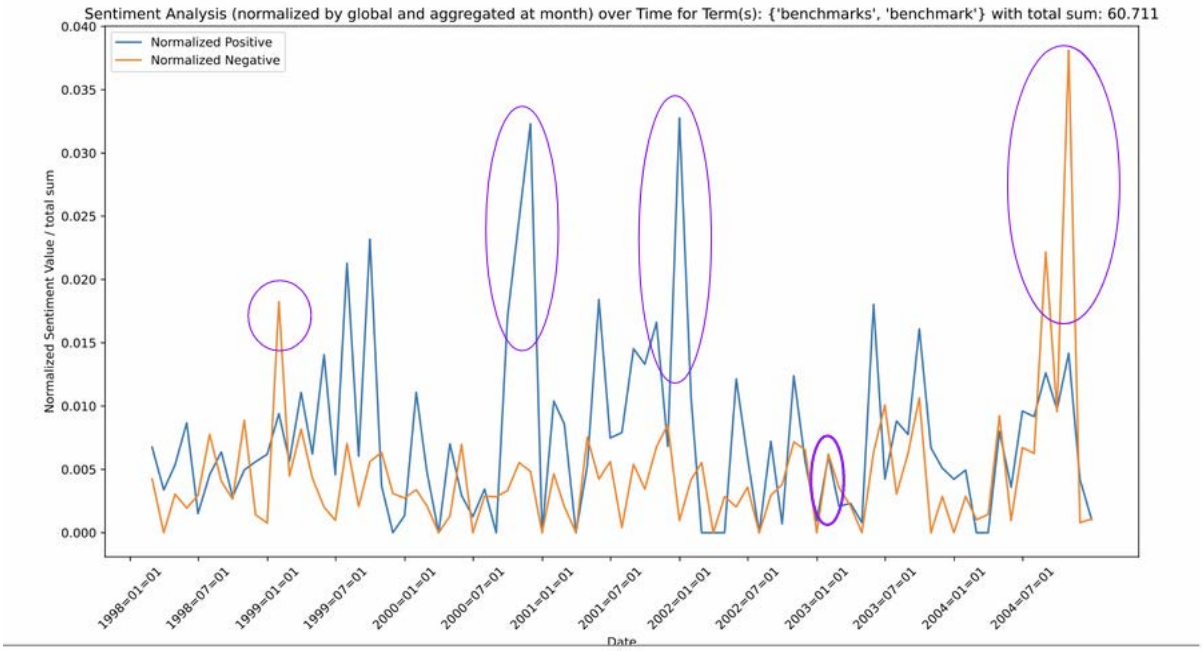

Figure 61: This graph displays the positive and negative sentiment values for the terms "benchmark and benchmarks" over the period of Jan. 1, 1998 - Dec. 31, 2004. The sentiment values were normalized based on the sum of the positive values and negative values for the searched term. This graph highlights 5 spikes in the data circled in purple.

Figure 61 presents the sentiment analysis for the terms 'benchmark' and 'benchmarks' spanning from January 1, 1998, to December 31, 2004. This graph reveals significant fluctuations in sentiment about 'benchmarks' throughout this period. The pattern observed shows an alternating dominance between positive and negative sentiments in the public narrative. Notably, the sharpest increases in positive sentiment coincide with the initial implementation phase of NCLB. Conversely, two significant negative sentiment spikes are observed: one occurring in the lead-up to the introduction of NCLB and the other a few years later, as the effects of NCLB's initial implementation began to manifest more concretely.

Positive and Negative Sentence Trends in 'benchmark' Sentences

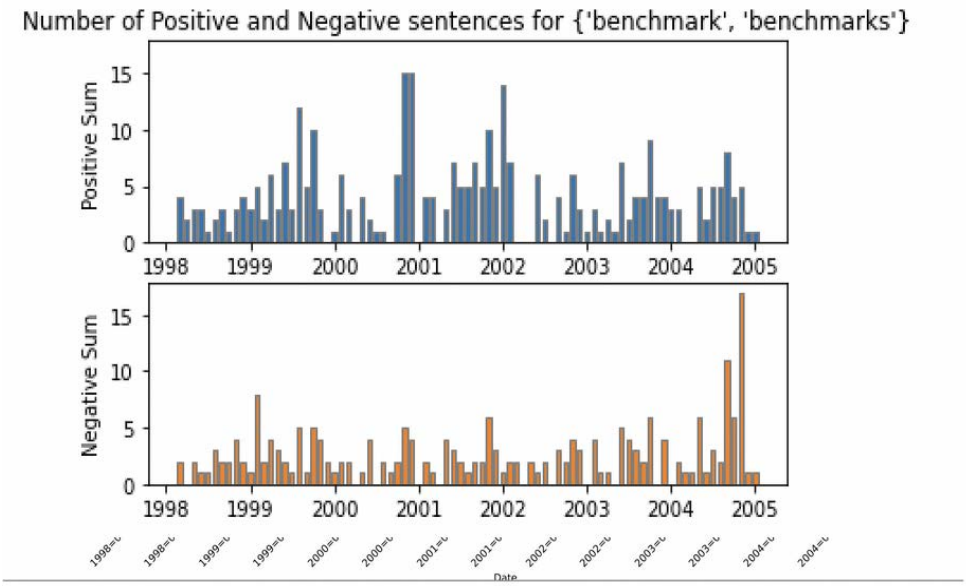

Figure 62: This is a bar chart showing the number of positive and negative sentences for the terms 'benchmark and benchmarks' over the period of Jan 1, 1998 – Dec. 31, 2004. The bars represent a monthly aggregation of sentiment values. The sentiment values in this bar chart are calculated as the absolute value (0 or 1) of sentiment (positive or negative) within a sentence.

Figure 62 offers an analysis of how much discourse in the corpus focused on 'benchmarks' with either a positive or negative tone. The graph highlights a significant increase in discussions portraying 'benchmarks' positively, especially during the period surrounding the implementation of NCLB. This notable uptick in positive sentiment warrants a detailed examination which will be conducted through a close reading of the articles contributing to this spike. In contrast, the graph in Figure 62 also shows that negative discussions about 'benchmarks' were relatively infrequent until the end of 2004, at which point there is a noticeable increase in negative sentiment. This shift towards more negative discourse will also be explored in-depth by closely analyzing the articles that influenced this part of the graph.

A close read of the benchmark narrative

Drilling down into one graph

This section takes a closer look at the stories behind the big shifts in sentiment shown in Figures 61 and 62. It hones in on two specific times that stand out in the conversation about ‘benchmarks’ surrounding the NCLB reform period. The first is a positive sentiment peak between July and December 2000, and the second is a negative peak from July to December 2004. Table 10 presents the articles (referenced by their goid) from which the sentiment data for 'benchmark' were derived. Only articles with a sentiment score over 1 (displayed in the center column and presented as the absolute value) were examined. What follows is a distilled summary, shedding light on how the subject of 'benchmarks' was talked about during these pivotal periods.

Table of Articles with High Sentiment Values During Key Time Periods

Pos_Flag >1 from 7/00 to 12/00		
409045153	2	9/15/00
409060519	2	10/12/00
409034673	4	10/26/00
409033165	5	10/29/00
409038223	5	11/2/00
409038340	3	11/2/00
409084476	3	11/9/00
409046247	3	11/15/00

Neg_flag 7/04 - 12/04 >1		
409765020	2	7/1/04
409777932	3	9/2/04
409834703	4	10/24/04
409729090	4	10/24/04
409830607	2	10/26/04
409697426	2	10/26/04

Table 12: This table displays a selection of articles, identified by their goid numbers which have sentiment values greater than 1. The center columns present these sentiment values as absolute numbers. On the left side, the table lists articles with positive sentiment found in the corpus between July 2000 and December 2000. The right side details articles with negative sentiment from July 2004 to December 2004. These specific time frames correspond to the notable sentiment spikes that are the focus of this analysis.

The articles were read in the sequence of their occurrence. Initially, the positive articles were generally celebratory and focused on school success. But it soon became clear that only one success was being celebrated – schools meeting the state's test score targets. The narrative took the tone of "nothing to worry about - let's just work hard. And, if you don't agree now, you will."

Within the reporting, some mild criticisms of the push toward school success measured by standardized tests were included. One reporter stated that "several Fairfax school officials and parent activists said the latest results have not changed their view that the multiple-choice tests are too narrow and force teachers and students to spend too much time on boring drills to prepare for the exams" (Benning, 2000b, p. 2). Showing mixed feelings of pride for the current student achievement growth while also voicing concern, this superintendent shared his view that "the state should not have made the tests the sole

factor in determining which students graduate and which schools are accredited" (Benning, 2000a, p. 2). And there was the backdrop of voices making comments such as, "If you believe we ought to be offering a more enriching curriculum than the SOLs provide, then you ought to be concerned" (Benning, 2000a, p. 2).

But throughout the 2000 news reports, the choir kept singing the praises of improved results. This helped create an echo chamber forming a strengthening boundary around the values being promoted while also serving to keep out or 'silent' any competing value. For those still worried, no need. "I know that there has been a lot of distress and gnashing of teeth and complaining about these tests", said Fairfax School Board member Mychele B. Brickner (At Large). "I hope with these results there will be a lot less anxiety…I would hope that naysayers who didn't believe we could do it realize the benefit that this kind of accountability has had" (Benning, 2000a, p. 2).

The voices of parent leaders entered the discourse, but still the critique was presented in a muted and mild manner. One PTA President stated it this way, "While we welcomed seeing the higher scores, we don't want to be fooled into thinking students are better educated. It means that teachers are more experienced in teaching to the tests" (Benning, 2000d, p. 1) These types of questions asking about the purpose of education, showing up here and there, alert the observer to a potentially fundamental shift in the foundational purpose of education in terms of the values the institutional of education embodies and what purpose it functions to fulfill.

Despite the occasional mild criticism, throughout 2000 the narrative kept up its positive energy with the most enthusiastic announcement yet that Loudoun County, "who

have been some of the harshest critics of the state testing program" made incredible gains across their entire school system. If test scores can well up excitement, they did. As the assistant superintendent of instruction exclaimed, "I'm very excited; I've been jumping all around" (Seymour, 2000, p. 1). Across the district, excitement inside the walls of these "achieving schools" led to impromptu pep rallies. Schools that met benchmarks were 'abuzz' praising the improved test scores.

Some of the more tempered voices during 2000 reminded us that "this is not a race" and the success comes from a lot of consistent, regular progress. (Seymour, 2000). When asked about the changes Loudoun County made to get such astounding results, the voices of those interviewed pointed to many of the collaborative practices. These practices included curriculum mapping and lesson planning as well as some of the cornerstones of educational improvement such as teachers and students spending more time together learning which was accomplished through 'early back to school' programs and after school test preparation sessions. Innovation was taking place, in Loudoun County specifically, in the form of devising "games and other 'fun' activities to help teach material tested on the multiple-choice exams" (Seymour, 2000).

The superintendent of the school district, even though he led the efforts toward improved test results, "has been a vocal opponent of the high-stakes testing program, calling it inflexible and penalties too harsh". The article closed by presenting the odd notion that the Superintendent, who was on vacation when these results were reported, would somehow return with a change of heart, not because the logic in his opposition would be revisited but because since he was now on the "winning team", he would join

the cheering voices of the movement.

Aside from the general celebration of schools' achievements, and overt disapproval of those failing schools, some skeptics stated that the effort to raise test scores at times brought "more innovation, get more resources and decreased class size, that's a positive outcome" (Benning, 2000a, p.3). Others made suggestions for improvement like welcoming more state aid, hiring more specialists in certain subject areas, and receiving more money for materials. Embedded in these requests are insights into what conversations, what resources, what needs existed on the ground, within the classroom walls. These voices were interspersed throughout the articles but amounted to no more than simple statements.

In the earlier articles of 2000, opinions by "testing experts" and a former dean of a Graduate School of Education were solicited. Clearly, at that time, there was uncertainty regarding what the focus on standardization would produce. These are clear indicators that the overarching question was not so much about 'meeting standards' but rather about the purpose of public education itself. Is the point of education to pass a test or is there more to it? The former dean asked that question, "Teachers are teaching to the content of these tests. Is that good or bad? If you believe these assessments accurately capture what children know and should be able to do, you think this is good. If you don't believe that, you likely think this is compliance behavior of the lowest form" (Benning, 2000b, p. 2) One parent raised the question of what we mean by "better education" in statements such as, "improved SOL scores do not necessarily mean that students are receiving a better education" (Benning, 2000a, p. 3). But the narrative anchored the idea of school quality

and school success with meeting the state testing benchmarks.

It is the comments and questions asking about the purpose of the institution and the questions asking what the institution values, that indicate a serious instability in the institutional field. The isomorphic pressures on the system of education due to this unprecedented top-down federal legislation were clearly asserting change within the field. Reading these articles from the early phases of NCLB's formation revealed the chorus of cheerleaders encouraging a pursuit toward this single goal.

From the same 2000 batch, there were also some sentences expressing negative sentiment. The results here were surprising. Rather than expressing negative sentiment towards the imposition of benchmarks, this group was generally expressing negative sentiment toward those who wouldn't meet benchmarks. When encouragement was not enough to gain success in meeting the goal, punishment was added for those who failed. And when encouragement and punishment fell short, offering cash dollar incentives to schools and teachers for raising test scores was introduced.

The first mention of "penalties" was in mid-October 2000. This indicated a shift in the narrative from a question about the ability to "retain accreditation", followed by simply stating the possibility of "loss of accreditation" which is, in itself, something to catch the reader's attention. But now, a "loss" has become a "penalty". And these penalties should help us raise student test scores. "Testing experts" chimed in to say "the penalties for poor performance are a strong motivator" (Benning, 2000b, p. 2).

By the end of October 2000, the public was being educated on the variety of labels given to schools such as "accredited with warning" or "full accreditation" and solutions

offered to “failing” schools became a focus of the conversation. The solutions presented to help failing schools succeed were the following two directives. One, “develop a plan for improvement” which later became known as a “school improvement plan.” Two, homogenize/standardize the curriculum and associated pedagogy with the help of newly designed mandated methods of instruction approved by the State for schools who received a warning due to low SOL scores in English or Math. And, doing anything other than ‘teaching to the test’ was ridiculed. As one principal announced, “Everything is correlated to essential learning as opposed to cutesy teaching. I hate to call it that, but in this case, you have to weed out what’s important and just focus in on that” (Wax, 2000, p. 2).

Schools and specific populations became the antagonists in the narrative of the ‘challenged to succeed’. Alternative schools, special education centers, and students at or below the poverty line became the ‘targets’ of improvement.

The narrative representing the last spike in late 2000 came from the articles with an absolute value of negative sentiment greater than one. These articles, as a whole, represent a much more cohesive message than the articles from the spike in early 2000. The topic of focus was “failing” schools: which schools were failing, watch lists, corrective action, “subgroup” performance - mostly discussed as ‘failing performance’ - even stating that special education programs “concentrating them in certain schools, it makes it [meeting school achievement standards] hard to overcome” (Trejos, 2004, para.8). The details of subgroup populations started to take shape – immigrants, identified as a growing population, will challenge schools to meet benchmark, high poverty schools were being denied federal funds for tutoring with those dollars going, instead, to for-profit providers.

And talk about ‘failing schools’ morphed into talk about ‘failing school systems.’ Failing became the center of our attention.

So much of what was happening to the educational system could be gleaned from the topics missing in the narrative. In 2000, there were questions about the purpose of our education system and there were voices advocating for what was needed in our classrooms outside the ‘testing’ program. As an example, one reporter stated, “Some teachers, parents and school administrators contend that the SOL tests tend to reward rote memorization rather than analytical skill. Some also have complained that the penalties for low performance are too strong” (Benning, 2000b, p. 2).

By 2004, those voices of hopeful suggestions as well as those voices questioning the larger purpose of education were gone, or at least absent from the space they previously occupied, which is the narrative around ‘benchmarks.’ The purpose of our education system became a question that was lost in the flurry of chasing after “success”, avoiding “failure” or punishment. And parents had choices. No longer were the parents' voices part of the narrative. Instead, they were treated as consumers and customers presented with options to meet their needs. If their school was failing, they could choose to remove their child from a “chronically failing school” and place their children in another school. The transportation costs to get the child to the new school would be paid for by, of course, the failing school, just one more punishment to motivate the school to stop failing!

In the early days of NCLB’s roll out, voices advocated for broadening the focus away from that single performance objective. By 2004, the voices speaking for elements of our education system beyond that of testing were all but drowned out by those who saw

only winners and losers, schools that succeed and schools that fail, students who meet benchmarks and students who did not. And worse, because children were placed into categories such as English-language learner, special education, race, or socio-economic status and these subgroups each needed to meet benchmark for a school to meet benchmark, the narrative shined a brighter light on those specific marginalized groups that were failing. Much of the conversation by the end of 2004 focused on the failing schools and the specific subgroups who were bringing down the rest of the schools' adequate yearly progress marks.

Part Four: Applications, Findings, and Discussion

With the nonlinear context and the adaptive institutional topology theory outlined in Part One, the methodology and the narrative value-based coding explained in Part Two, and an example of the institutional field modeled according to the complexity paradigm in Part Three, it is now possible to describe a foundation for a new normal science under the nonlinear paradigm. This section, Part Four, is divided into four parts. The first examines differences in utility between the paradigmatic perspectives regarding institutional fields and seeks to identify objectives each approach could more fruitfully support based on the notion of the institutional field. The following three sections address issues related to creating a new normal science of topologically understood fields from the nonlinear paradigm. The second section will examine the importance of paradigmatic views of externalization and internalization on modeling concepts and potential approaches to studying field behavior. The third section will explore sustainability, resilience, and legitimacy as field behavior rather than as aspects of a hierarchical schematic. The fourth section will explore how practitioners and researchers could use the proposed new normal science to aid decision-making as well as for understanding our complex world.

Managing for outputs or capacity: differences in utility between the two paradigms

Addressing the utility of each paradigmatic view involves identifying first *that a relationship exists* between managing for outputs using traditional efficiency-oriented theory and dealing with unexpected feedback. Once the link is established, then its nature can be explored. Limited resources and diverse social needs drive efficiency and outcome-oriented planning processes. Linearizing schematics are well established and well understood as appropriate modeling approaches for project management. However,

complexity and nonlinearity are an inescapable landscape upon which a social pattern unfolds. The discovery of chaotic patterns in nonlinear dynamics, chiefly that long-range predictions of complex dynamic systems are, as Edward Lorenz (1963) put it, "*impossible by any method, unless present conditions are known exactly*" (p.141), are slowly entering our collective zeitgeist (Forrester, 1971, 1975; Gleik, 1987; Morçöl, 2012; Walby, 2007; Wheatley, 2006; Morgan et al. 2019). The implications for predictive modeling of social systems are profound. *Emergence* is now recognized as a systemic creative category distinctly lacking intentional qualities (Johnson, 2002). Emergent systems are, by definition, generated from bottom-up processes. The entire concept of purely top-down solutions to systemic problems fails under the addition of feedback and complexity.

This is not entirely unsurprising. Defining problem boundaries at an institutional level involves making a connection between personal experience and shared experience. There is a source of randomness added into the mix, which C. Wright Mills (1959) brought to the attention of sociology as a discipline. The distinction between what he calls troubles and issues is a distinction between what we can see at a systemic or institutional level and what happens at a personal level and is not, for all practical purposes, visible at the institutional level. In his words:

> Perhaps the most fruitful distinction with which the sociological imagination works is between 'the personal troubles of milieu' and 'the public issues of social structure.' This distinction is an essential tool of the sociological imagination and a feature of all classic work in social science.
>
> Troubles occur within the character of the individual and within the range of his or her immediate relations with others; they have to do with one's self and with those limited areas of social life of which one is directly and personally aware. Accordingly, the statement and the resolution of troubles properly lie within the individual as a biographical entity and within the scope of one's immediate milieu - the social setting that is directly open to her personal experience and to some

> extent her willful activity. A trouble is a private matter: values cherished by an individual are felt by her to be threatened.
>
> Issues have to do with matters that transcend these local environments of the individual and the range of her inner life. They have to do with the organization of many such milieu into the institutions of an historical society as a whole, with the ways in which various milieux overlap and interpenetrate to form the larger structure of social and historical life. An issue is a public matter: some value cherished by publics is felt to be threatened. Often there is a debate about what that value really is and about what it is that really threatens it. This debate is often without focus if only because it is the very nature of an issue, unlike even widespread trouble, that it cannot very well be defined in terms of the immediate and everyday environments of ordinary people. An issue, in fact, often involves a crisis in institutional arrangements, and often too it involves what Marxists call 'contradictions' or 'antagonisms. (pp.8-9)

Troubles are personal and are not visible to a high-level view. They only become visible when the systemic pressures that cause one person's troubles begin to feedback through the system and aggregate. Mills uses the example of one person who is unemployed versus a significant fraction of the population being unemployed. Though there is a connection, the forces which lead to the individual's troubles are personal, having to do with that individual's navigation of the system. But when a significant portion of the population becomes unemployed, the systemic issues that led to this state of affairs must collectively be considered, typically involving a public debate over public values.

Using topic modeling and sentiment analysis over large data sets and visualizing emergent issues as value conflicts on a landscape, Mills' 'issues' can potentially be identified as they emerge. It is possible to observe what is actually happening or what has actually happened in emergent terms without needing to identify the social events beneath the surface. If researchers are not wedded to a particular outcome to the exclusion of emergent issues, then this kind of analysis can help us navigate a changing landscape.

However, attempting to force the landscape to fit a prearranged outcome often results in emergent issues being perceived as mere random problems frustrating the path to achieving an idealized stable equilibrium.

Phillip Selznick (1953) conducted a thorough study of the story of the Tennessee Valley Authority (TVA), a New Deal agency established during the Great Depression. The book explores how the TVA pursued the goal of addressing economic and social issues in the Tennessee Valley region through large-scale infrastructure projects, managed in partnership with local communities and grassroots organizations. According to Selznick, the TVA was something of a grand experiment in decentralized administration.

In an adaptive systems environment, one of the commonly recognized aspects is that there "is no single point(s) of control. System behaviors are often unpredictable and uncontrollable, and no one is "in charge." Consequently, the behaviors of complex adaptive systems can usually be more easily influenced than controlled" (Rouse, 2008, p.18). Under that set of assumptions, the effort to bring the administration of the project to the local level makes substantial sense even though adaptive systems were largely unknown during the period of Selznick's study. However, the actual experience on the ground was less than perfect.

Despite the TVA's goals of community engagement, balancing top-down planning with grassroots involvement proved to be a complex endeavor. The local elites used their new authority to dispossess poor and largely black landowners and generally misappropriated significant funds to their own ends. This was apparently a surprise to the federal agencies who managed the federal level of the project.

The questions those leaders asked about the system which existed already in the region did not include value questions in the sense of values as classifiers. They did not ask what the system was *disposed to do*. The boundaries around the plan included the federal government's goals. Those goals included developing decentralized structures to administer federal programs, but they did not take into account the goals of the local elites. The technology to do so was largely unavailable at the time anyway. Would those federal leaders have benefitted from being able to identify the topics and sentiments that the local elites were infusing in their local institutional fields?

As attractive as top-down solutions to perceived problems in the K-12 education system might be, it is evident that they cannot succeed at the field level, although this realization does not diminish the ethical responsibility to seek and implement effective solutions. Education is a nonlinear process – and one of the classic 'wicked problems' as defined by Rittel and Webber (1973). Attempts to solve a wicked problem through top-down authority inevitably causes other problems elsewhere in the system where goals conflict.

Indeed, the long-term legacy of NCLB has not been favorably reviewed in general. It has contributed to a national teacher shortage (Boyce, 2019), collapsed innovative teaching models that served as laboratories and incubators (Rodriguez, 2015), and has not made the gains in test scores or in closing the achievement gap that were provided. Even if NCLB had made short term gains, the effect of delegitimizing the role of professionalism in education clearly will have long term consequences. As Linda Darling-Hammond (2022) explains,

> The 55 percent [of teachers] who left because of dissatisfactions with teaching cited multiple concerns about the effects of testing and accountability policies on teaching, lack of influence over school policies and practices, lack of autonomy in the classroom, and inadequate opportunities for leadership or professional advancement—symptoms of a de-professionalized occupation. (Subpar Conditions section, para. 3)

But humans are not bound to a linear viewpoint by any cruel law of nature. Rather, the transition to a nonlinear perspective has not yet been fully realized in prevailing ways and habits of thinking. Rod Cunningham (2000) provides a number of empirical examples offering insight into how complexity theory applies to the institution and practice of education: formative assessment feedback and learning, school-level examples, and learning as central to the understanding of educational communities. These examples offer context to Margaret Wheatley's (2006) conceptual framework for leadership based in a nonlinear paradigm incorporating complexity and nonlinear dynamics.

The damaging effects of taking insufficient account of the dynamic nature of schools (Cunningham, 2000) is clearly shown in Knoester and Parkingson's (2017) study. They point to "[s]tandardization attempts to bring a simplistic and linear map to an intrinsically complex ecology, resulting in needless stress, distraction, and dehumanization in school" (Knoester and Parkinson, 2017, p. 247). This serves as a reminder to leaders. These "linear" maps do not appear simply from attempts to standardize. Linearity is a paradigm that informs our mental maps. Non-linear, dynamic systems simply follow different logics. And a wide range of scholarship now offers insight into how one can use those logics to work within a nonlinear system. Philip Anderson (1999) presented models demonstrating how: "Strategic direction of complex organizations consists of establishing

and modifying environments within which effective, improvised, self-organized solutions can evolve" (Abstract). Gareth Morgan (2006) offers some tips for how managers can reframe their thinking under this "new" paradigm of complexity. This is similar to Hugh Heclo's (2008) request that we "think institutionally" meaning that we engage *in* the dynamics of the institutional life rather than engineer solutions *for the* institutional life. And, Margaret Wheatley (2006) frames the concept of leadership in a paradigmatic way to help managers understand and work with the complex, self-organizing behavior exhibited by organizations.

Management and even bureaucratic forms are inherently a practice of linearization. When employed to the degree such as that promoted in early scientific management literature (Taylor, 1916), management "tries to be instrumentally single-minded, guided wholly by norms of purposive rationality" (Selznick, 1992, p. 291). The subtlety in this opening sentence in *Education in American Society* (Hillway, 1961) can easily set the stage for a machine bureaucracy to start turning the cranks and producing finely engineered citizens. It reads, "Children are the raw material out of which we build our society through education" (p. 53).

The actual, on the ground operations within the institutional field are responses to nonlinear behaviors within the field. There will be natural variation. Top-down plans can be detrimental if those plans are seen as able to address emergent problems. The problem with wholesale reforms to adaptive systems is that the outcomes cannot be predicted. They are essentially a toss of a dice with only one number likely to produce marginal gains and all other numbers likely to produce loss.

While outcomes of top-level plans may not be predictable, what can be addressed from the top is the quality of conditions on the ground level. Rather than say, “I don’t care how, just produce this outcome and get rewarded or fail and get punished” or even laying out a strategy to produce an outcome, which was the basic approach of NCLB, instead, one can say, “Do the conditions in the classroom enable teaching and learning?” If the conditions you create in pursuit of an outcome do not favor the process you want to encourage, then the outcome being other than your goal becomes a foregone conclusion.

Focusing on conditions places efficiency and outcome-oriented planning within the framework of open systems. There are countless issues of logistics involved in supplying a school district with the materials it needs to promote conditions that are conducive to teaching and learning. Even in the pursuit of linear processes, there are myriad value issues that are likely to arise. Yet, these value issues can largely be boiled down to either simple or complicated problems (“tame problems”) rather than complex problems. Buildings and maintenance, textbooks, clean water, nutritious food, and countless other operations related processes are excellent candidates for efficiency and outcome-based thinking, as long as they are placed within the larger context of sustainability and resilience.

Externalizing and internalizing values and stakeholders

The institutional field, operationalized as a topological landscape where values compete for institutionalization and reified as a dynamic pattern in time, enables the viewing of inclusion and exclusion as both empirical and normative qualities under the rubric of externalization and internalization. Identifying the values and signals infused into the field through document analysis reveals what the field is treating as a boundary by what signals are placed in a negative context and vice versa. Because of this, the logic of

persistence is a central consideration to the foundation of a normal science capable of studying complex systems in their own right.

Originally borrowed from biology where it describes the self-generating systemic quality of living systems, the concept of *autopoiesis* was adapted to a social science context by Niklaus Luhmann, (1995), Gareth Morgan, (2006), and Stafford Beer (1985). Autopoiesis describes a self-generating, self-governing system which challenges our notions of reification through a process view, definable only as a dynamically maintained set of relationships like the example of the eddy from section one. Morgan (2006) explains,

> They do so by engaging in circular patterns of interaction whereby change in one element of the system is coupled with changes everywhere, setting up continuous patterns of interaction that are always self-referential. They are self-referential because a system cannot enter into interactions that are not specified in the pattern of relations that define its organization. Thus, a system's interaction with its "environment" is really a reflection and part of its own organization. It interacts with its environment in a way that facilitates its own self production; its environment is really a part of itself. (p. 244)

How one reifies the systemic, structural elements of an institution or institutional field significantly impacts their understanding of it. This understanding both constricts and directs the choices made regarding interactions with those elements. In turn, these choices shape the institutional mechanisms themselves. When the institution is defined as a persistent system, with attention to the inflows and outflows that occur as the system continuously regenerates itself and maintains dynamic stability or persistence, the notion of *autopoiesis* is being employed. The system itself is not *for* anything. The autopoietic system *acts and behaves* as part of the processes of maintaining persistence and dynamic stability.

Understanding a system teleologically leads to the reification of structures that satisfy functional desires as permanent, because the function is abstracted from the system. The function is what the system is for, rather than a condition of the system state. Consequently, *all related potential action is then defined in terms of outcomes* because the thing has been defined by its purpose. This approach focuses attention on concerns of the health of the system itself, specifically focusing on only those aspects contributing to turning inputs into outputs. Whatever is externalized is lost from view. Externalized forces that are intentionally kept out by the boundary become indistinguishable from random external forces. If the externalized forces happen to amplify in a positive feedback loop, this pressure will be sudden and without warning. Only in hindsight, if ever, will it be clear that the energy powering that feedback came from the operation of the linearized sequences of the system itself.

The research results showed that anomalous behavior in the sentiment analysis represented articles with clearly externalizing values and classifiers. A value was being given to the field as a whole through a federal effort directing agents in the field to define education in success and failure terminology with narrow definitions of those terms. In hindsight, it is evident that the eventual pushback and crisis in program diversity, along with the willingness of agents to take on teaching as a profession, were forces that were present all along. The value that pushed into the system with NCLB came with a thick, resistant boundary – a boundary that caused real concerns to go unnoticed and build up until an emergent crisis appeared and what was externalized could no longer be ignored. Troubles, caused by the reforms turned to issues and the institutional field is now faced

with a crisis which outcome-oriented values infused in the institution through NCLB are unequipped to address.

Modeling and methodology to include sustainability, legitimacy, and resilience metrics for a nonlinear normal science investigating an institutional field

To understand the dynamics of the institutional field as an adaptive system is a different quest than to understand the dynamics of the parts of the system as those parts contribute to its function. Before posing the questions, "what does [policy X] *do to the* system?" and "does that change affect the health or *sustainability* of the system?", it is essential to first have a clear understanding of the system's structure. Additionally, the concept of sustainability, as it applies to a social institution, must be clearly defined. We also need apt metaphors to facilitate our understanding of how to go about answering those sorts of questions. New visualization techniques and new metrics against which to measure the stability and health of the system itself require new conceptual principles. The final section of this research adopts the principle of resilience as introduced by C.S. Holling (1973) and borrows conceptual schemes from the Social-Ecological Systems (SES) paradigm which traces its roots largely to Holling's (1973) seminal paper, *Resilience and Stability of Ecological Systems*.

Problems stemming from systemic roots at multiple scales, across multiple jurisdictions, and involving a wide range of stakeholders share similar management challenges. It is difficult to measure network effectiveness when the problem cannot be adequately defined let alone quantified. And when diverse and dispersed organizations dealing with the same classes of issues have sometimes significantly different goals due to the local needs and conditions, conflict is inevitable when top-down solutions attempt to

infuse narrow values into the field.

Despite the difficulty, a governance theory for managing Social-Ecological Systems (SES) has developed a remarkably robust framework for connecting systemic social concerns at multiple scales with governance networks. Based on key insights found in C.S. Holling's seminal (1973) paper, *Resilience and Stability of Ecological Systems,* scholars, including Holling, have developed a coherent body of cross-disciplinary research on the SES management paradigm (Frantzeskaki, Slinger, Vreugdenhil, and Van Daalen, 2010; Walker, Holling, Carpenter, and Kinzig, 2004; Folke, Hahn, Olsson, and Norberg, 2005). This work has been integrated into a concept that Holling calls "Panarchy" (Gunderson and Holling, 2002), although many scholars use the SES label and consider panarchy a conceptual scheme utilized within SES. In that original 1973 paper, Holling proposes that, "[d]ifferent and useful insight might be obtained, therefore, by viewing the behavior of ecological systems in terms of the probability of extinction of their elements, and by shifting emphasis from the equilibrium states themselves to the conditions for persistence" (p. 2). He called the concept of this measurement *resilience*. One immediately apparent advantage is that it identified an entire range of contemporary conservation policy that might actually be leading to irreparable state flip. As Holling (1973) describes:

> An equilibrium centered view is essentially static and provides little insight into the transient behavior of systems that are not near the equilibrium. Natural, undisturbed systems are likely to be continually in a transient state; they will be equally so under the influence of man. As man's numbers and economic demands increase, his use of resources shift equilibrium states and moves populations away from equilibria. The present concerns for pollution and endangered species are specific signals that the well-being of the world is not adequately described by concentrating on equilibria and conditions near them. Moreover, strategies based on these two different views of the world might well be antagonistic. It is at least conceivable that the effective and responsible effort to provide a maximum sustained yield from

> a fish population or a nonfluctuating supply of water from a watershed (both equilibrium centered views) might paradoxically increase the chance for extinctions. (p. 2)

Additionally, his insight also offered a logic for reifying dynamic governance networks that address wicked problems. Rather than compress the time dimension and reify the network into a static structure with responsibility for particular social services, SES reifies the network as a component of a "complex system of people and nature, dynamically organized and structured within and across scales of space and time" (Allen, Angeler, Garmenstani, Gunderson, and Holling, 2014, Abstract). This particular logic of reification acknowledges that complex, dynamic social issues cannot be managed for equilibrium precisely because of their dynamic and nonlinear nature. In SES, the reified outputs are attractor basins, the reified inputs are events, and the network connections do not require stable persistence (Walker et al. 2004; Frantezaki et al. 2010; Folke et al. 2005).

The units of analysis are individual Social-Ecological Systems associated with a particular attractor basin at a particular scale in a recursive system, meaning that cross-scale dynamics are built into the reified concept. Perhaps their orientation in ecology and environmental management makes complex multi-scale interaction a natural extension of their governance. This tendency could stem from the fact that ecological systems frequently involve cross scale dynamics. Local systems have their own dynamics that both affect and are affected by watershed level dynamics that both affect and are affected by regional level dynamics and on up the scale.

The SES approach to management of individual Social-Ecological Systems associated with specific attractor basins utilizes adaptive governance structures that self-

organize around management issues (Folke et al., 2005). The organizing principle of governance in SES is promoting adaptive capacity, the capacity of the overall system to adapt to changing conditions.

Information and leadership arrangements can be both bottom-up as well as top-down, reflecting the adaptive and multi-scale nature of the system. But, relatively complex stakeholder engagement processes and a reliance on institutional support for those engagement processes are critical components of the success of SES. Accomplishing coordination across geographic and jurisdictional levels or across geographic and jurisdictional scales relies to a large degree on the homogeneity within the scientific field of environmental services and the intentional maintenance of social networks across the field (Folke et al., 2005).

These authors also note the recent emergence of some bridging organizations. These organizations assemble networks and coordinate information sharing, suggesting that such bridging organizations may reduce expenses related to collaboration and conflict resolution. Unfortunately, there is not any space here to devote to a thorough treatment of these arrangements. Nevertheless, these dynamic networks do self-organize and several examples of successful applications of the principles are available in the literature (Folke et al., 2005; Cash, D., Adger, W. N., Berkes, F., Garden, P., Lebel, L., Olsson, P., ... & Young, O., 2006; Walker et al., 2004; Gunderson and Holling, 2002). The similarities to the institutional field of education operating within a larger social milieu are strong enough to warrant the attempt to utilize aspects of their conceptual scheme.

SES approaches to modeling human systems as components of linked social-ecological systems include attractor basin models as a visualization technique describing the system. The point of such models is to demonstrate the resilience of a system - defined essentially as the space across which a point can move without moving out of the basin and into a new basin. The length of time that a point remains in the basin is the temporal persistence of the systemic configuration. Moving from one basin to another reflects the dissolution of the first basin and reorientation with a new resilient configuration and is called a state flip.

Three-Dimensional Stability Landscape

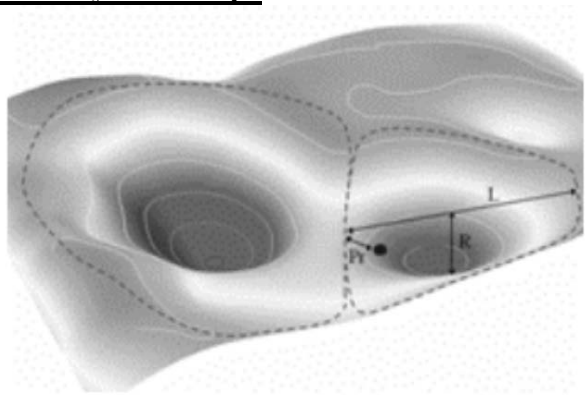

Figure 63: This image is taken from "Resilience, Adaptability and Transformability in Social-ecological Systems" by B. Walker, C.S. Holling, S. Carpenter, and A. Kinzig (2004, Fig. 1a). The image is a representation of a three-dimensional stability landscape showing two basins of attraction.

In a social-ecological system, the basin is typically used to describe the ecological configuration that the social systems (the people involved) collectively find desirable. According to Walker, et.al. (2004):

> The people in this system might consider some basins to be desirable (lots of grass, few shrubs, plentiful livestock) and the objective might be to prevent the system from moving into an undesirable basin (little grass, many shrubs, few livestock) from which it may be difficult or impossible to recover. (para. 12)

Resilience in this conceptualization refers to the linked system of landscape and society. This three-dimensional landscape, shown in Figure 63, is an example of how the institutional field landscape can be visualized.

In Walker et. al.'s (2004) conception of the attractor basin model, they use latitude, resistance, and precariousness as measures of resilience. As the system state moves closer to the edge, the particular system states within that attractor basin become more precarious. Very subtle disturbances can lead to a system state in a new attractor basin. In this case, state flip has occurred, and the original basin is very difficult if not impossible to return to.

Initial efforts have been made to apply the concept of resilience to communities and social systems decoupled from the ecological system (Wilson, 2012; Davidson, 2010). Wilson (2012) defines resilience:

> The generally accepted definition of resilience has been the capacity of a system to absorb disturbance and reorganize while undergoing change to still retain essentially the same function, structure, identity, and feedbacks (Walker and Salt, 2006). Resilience, therefore, is seen in this context as an emergent property – a relative attribute characterized by responses to disturbances which can only be assessed by looking at changes in a system over time. (p. 1211)

It is clear that, for this concept to be applicable to an institutional field, those functions, structures, identities, and feedbacks need to be identified and identifiable. By defining the institutional field as a landscape where a category of values competes for legitimacy, there exists a structure necessary to visualize attractor basins as configurations of values, internalized and externalized signals. And defining the landscape as consisting of all individuals who possess values that serve to convert signal into action, we have the substrate.

Returning to the topic visualizations produced by LDAvis (Figure 64), it is evident that the beginnings of a visualization technique are already in place. All it is lacking is depth.

LDAvis View of Landscape

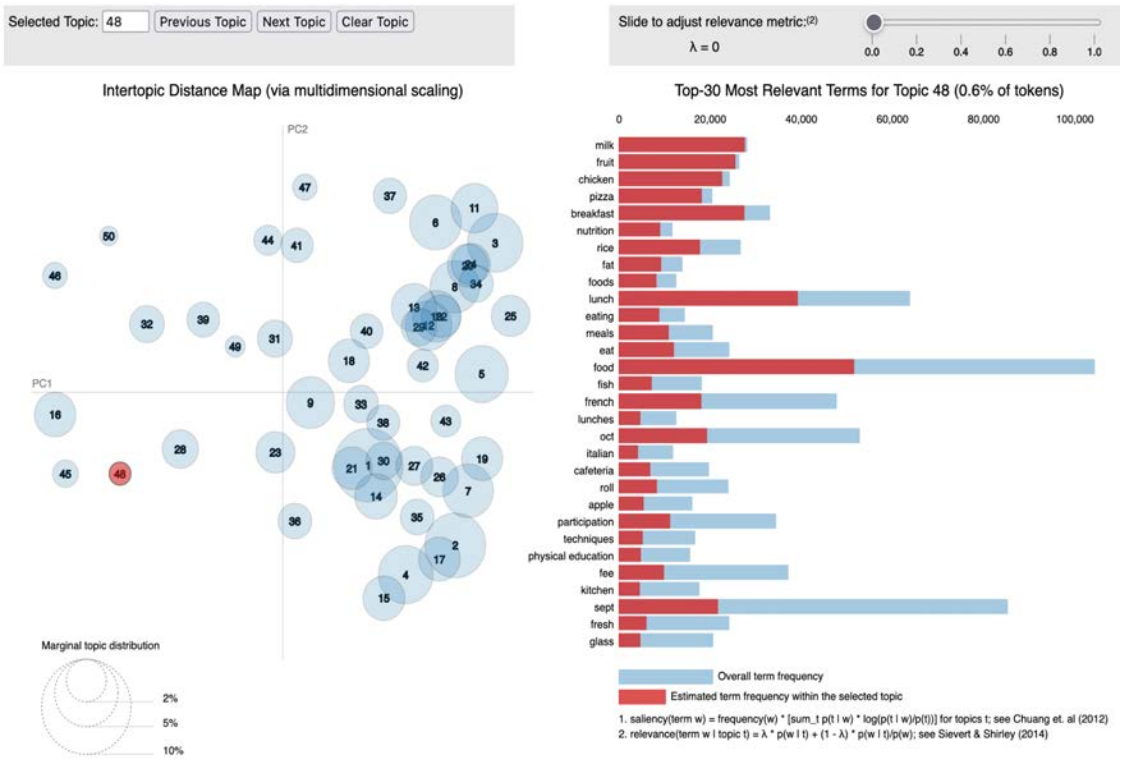

Figure 64: Screenshot of an LDAvis interactive graph. It is used here to show how an institutional field can be visualized, starting from this two-dimensional representation.

If the topics are taken as the signal, then sentiment can represent depth, and 'values competing for legitimacy' provide the depth metric: legitimacy. Westley, Olsson, Folke, Homer-Dixon, Vredenburg, Loorbach, & Banerjee (2011) present an application of attractor basin modeling that can begin to inform us how this could work and what its significance might be. They begin with the assumption that the existing institutional systemic social structures are failing to deal with potentially existential environmental

issues and that those institutional structures *should* be nudged toward a new basin of attraction which is better suited to address these challenges. As seen in Figure 65, their figure illustrates a way to see system states as outcomes themselves and also suggests a potential avenue for understanding institutions as systems.

Institutional Actors and System States

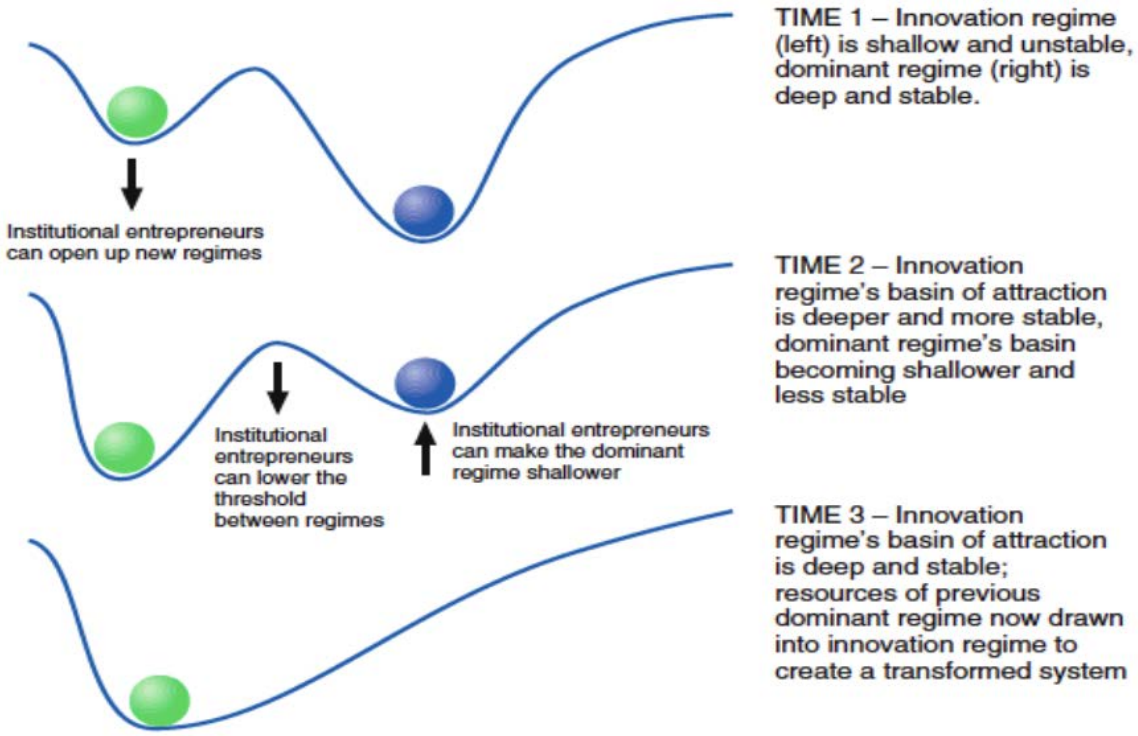

Figure 65: This image is taken from "Tipping toward sustainability: emerging pathways of transformation" by F. Westley, P. Olsson, C. Folke, T. Homer-Dixon, H. Vredenburg, D. Loorbach, and B. Banerjee (2011, p.768). This figure illustrates a way to see system states as outcomes themselves and illustrates how these basins of attraction can be affected by institutional actors.

By viewing the attractor basin as a configuration of values, it becomes apparent that the political process of intentionally initiating a state flip involves identifying and delegitimizing undesirable values while simultaneously generating legitimacy for a new

configuration of values. Returning to the sentiment analysis from Part Three, recall that the turbulence in the field can be viewed as exactly that. Through this framing, the tool also enhances media awareness, enabling the source, propaganda aspects, or represented interests to be set aside, as the question becomes tractable in a new and distinct manner.

The question then is, what does this proposed value do to the field as an attractor basin? What are we being asked to lose? What are we being asked to replace that with? Viewing the process in this fashion could provide stakeholders with a clearer vision of what will be lost and what stands to be gained with substantial changes. Such a view suggests entirely new ways of approaching both adaptive change as well as transformative change.

Using the new normal science to aid understanding and decision-making:

This research, while heavily theoretical, aims to provide practical value. It aims to be an addition to the manager's toolkit and to contribute to the literature for leadership, assisting those who seek to engage with the complexity of our nonlinear world.

Current leadership theories are often focused toward this longer-term vision of a system with a goal of sustainability. Based in systems thinking, Meadows and Wright (2008) advise that:

> You can't navigate well in an interconnected, feedback-dominated world unless you take your eyes off short-term events and look for long-term behavior and structure; unless you are aware of false boundaries and bounded rationality; unless you take into account limiting factors, nonlinearities and delays. You are likely to mistreat, misdesign, or misread systems if you don't respect their properties of resilience, self-organization, and hierarchy. (87)

What Meadows and Wright leave out is that there is a choice involved, a choice of what paradigm best suits the problem space a leader is confronted with. The choice of

paradigm dictates the choices available. Complexity includes process qualities such as feedback, dynamic system states, or attractor basins which do not “fit” within the linear paradigm. Therefore, decision-makers must *choose* the lens in which to view issues. It will become the discretion of the leaders, policymakers, administrators, professionals, and citizens to toggle between the appropriate application of two perspectives.

The tools and theory developed in this research are designed to model issues of social concern through a nonlinear lens and provide new language to construct our understanding of these issues. In the linear view, one sees permanence. In the nonlinear view, one sees persistence. In broad terms, this choice involves 1) identifying the linearizing tendencies of goal directed policies, 2) assessing what values are externalized through those policies, and 3) choosing the model that is most appropriate for satisfying the needs of those affected.

Lawmakers at federal, state, and local levels, whether in education, law, or healthcare, are tasked with designing and imposing the coercive structural aspects of an institutional field. They should be able to identify which values informed those structural decisions and which were excluded. Additionally, it's important for them to recognize and plan for flexibility, allowing feedback from the externalized values at multiple temporal and spatial scales. Administrators implementing those policies should be able to identify the values imposed from above (top-down, regulative, coercive) as well as those emerging from within their jurisdictionally local conditions (bottom-up, cognitive, mimetic), and those used by administration to inform policies to accommodate or otherwise cope with conflicts (horizontal, normative). Professionals within the institutional field and the

bureaucracy - teachers, counselors, specialists, contractors and others - should be aided in the process of identifying local problems and communicating to administrators when the professionals begin to see Mills' troubles converge into issues that fall within the institutional signal space. If the process is explicit in public engagement, members of the public interacting with the institution might be able to identify points of conflict and register instances and examples of that conflict within the institution itself.

While a nonlinear model may provide heuristics to inform behavior, as demonstrated in the above examples, the true value of this research lies in the nonlinear paradigm's ability to offer fresh insights into public education both as a system and an institution. Interested parties should be equipped to describe and explain the complex, 'wicked' aspects of the institutional field using the process-oriented metaphors and axioms developed in this research. While the predictive utility of a nonlinear model is qualitatively different from that of an outcome-oriented model, there is a clear predictive utility in identifying changes of system states through a methodology that can describe them, whether the states themselves are predictable or not. Adaptability can be designed in as responses to shifting attractor basins, shifting values, shifting resource bases, by providing a set of indications that signal dramatic change, allowing us to at least manage that change with a clearer understanding of what is changing.

The use of a cybernetics-oriented systems model, similar to those promoted by Jay Forester, faces challenges in predicting specific outcomes, especially due to the lack of specificity regarding initial conditions in complex systems like the institutional field of American public K-12 education. However, shifting the focus from a product to a process

orientation can illuminate potential cross-scale impacts. This shift can particularly highlight how short-term, goal-oriented projects might affect the overall state of the system. Ultimately, this research is created to offer scholars and practitioners a new perspective on institutional performance, a novel application of current models and tools, and a release from a pattern of thought that has left the institution of education stuck, under-nourished, and delegitimized.

Do we glance across the field of education and find diversity, multiple basins of attraction, spaces where a variety of values serve some greater purpose, feeding the ecosystem of a healthy institutional field? Or, are we finding the legitimacy of those basins being made shallow and potentially disappearing from the larger system: a system homogenizing, being engineered toward a single objective, a system becoming more and more rigid as it is pulled toward a narrowly defined purpose?

This research advocates looking for ways to tend to the conditions of healthy ecosystems and provides a warning when the need to accomplish an outcome turns the process into a mere means to an end. There are consequences to treating a complex dynamic system in a means and end fashion. Not only does the approach externalize any factors outside the simple ends by whatever means society will accept, but the interdependence of systems pulls too many resources into one domain without considering the conditions of the whole (environmental, economic, social - pillars of sustainability).

Leadership literature is filled with strategies and practices designed to build inclusive boundaries around systems, tend to conditions on the ground, and focus on the *process* of the work as opposed to pushing too hard toward *outcomes*. These leadership

strategies have been well explored in *New Public Leadership: Making a difference from where we sit* (Morgan et al., 2019). One such approach, specific to education, is defined in the book *Professional Capital* (Hargreaves and Fullan, 2012). Without explicitly stating their approach as paradigmatic, Hargreaves and Fullan (2012) provide ample evidence of the damages caused to our education system when a linearized approach is used. In essence, they advocate for tending the 'conditions of teaching' so that the profession itself is nourished. While they focus on the profession of education, their lessons generalize to other professions and fit well within the nature of the complexity paradigm.

The following quote reminds us that the education system is centered on our students, as it should be. However, as Hargreaves and Fullan remind, when tending to the conditions for teaching and learning, let us not forget to include the professionals as we tend to conditions for student success. "Successful and sustainable improvement can therefore never be done *to or ever for* teachers. It can only ever be achieved *by and with them*" (Hargreaves and Fullan, 2012, p. 45). And to elaborate, '*by and with them*', is not instrumental here. It does not suggest that teachers become tools used to accomplish an outcome. It is intended to be constitutive of what it means to be a professional, a leader, and a member of a community.

This research and proposed methodology do not suggest that there is a perfect solution, quite the opposite. The best that one can do is try to meet complexity with curiosity, try to learn about the conditions that bring about the states we desire, and be alert to the fact that in social systems, boundaries of the system are determined by the rules and values the system holds. These boundaries can expand through all of humanity (given that

our planet is our shared home) or they can be centered around issues or areas of practice. This recognizes the profound nature of the adage, don't make the perfect the enemy of the good.

When boundaries are defined, there is always something being excluded by that boundary. Therefore, it is important to take notice when it seems that an exclusionary boundary is being drawn or when one is found. In the case of 'benchmark' narratives around NCLB, the boundary quickly became a zero-sum proposition. The voices who questioned that boundary placed on "educational success" were dismissed and excluded from the conversation.

As I write this research in 2023, a little over 20 years after the implementation of NCLB, I no longer believe I share in a collective understanding of the purpose of education, not because I do not have beliefs that I share, but because the narrative is so comfortably seated in what education 'is not' rather than what education 'is'. If educational leaders and decision makers were to heed the advice of the leadership scholars who teach about the asset-based approach (Green, O'Brien, Moore, & Duncan, 2006; Block, 2009; Morgan et al., 2019), those educational leaders and decision makers may realize that the system has become so fixated on chasing after a metric of "success", as ever-shifting as that metric has become, they have forgotten to step back and take a look at what remaining beauty and success already surrounds us in these classrooms.

I mentioned in the preface that the magic in the schools was lost for me. But there is magic there. There are teachers who are magicians out there. Students bring their own version of magic into the classroom. The damage of being labeled a "failing" school has

created deeply systemic feedback and to break that feedback requires nothing short of transformation. Transformation happens in the positive space of seeing what is there, the assets in front of us. I am reminded of a saying I once heard, and I wish I could attribute it to its source, “the healing of our wounds results in the transformation and the transformation results in the healing of our wounds”.

Teachers who take the notion of healing our classrooms seriously will set up *the conditions* for healing to occur so that those within the classroom and those being served by the learning environment are nourished and able to support the process. The same is true at scale.

The possibilities inherent in utilizing the adaptive institutional topology approach and associated methods developed in this research for visualizing the institutional field as a topology are vast. Section Five summarizes the main ideas from the first four sections and explores the significance and possibilities presented by this research.

Part Five – A Summary and Significance and Possibilities

Over the course of this research, the complexity paradigm was defined, along with its application to the study of institutional fields. This led to the situating of adaptive institutional topology theory (AITT) within the realms of both institutional and complexity research. This research explored the theoretical foundations of adaptive systems and institutions. It devised methods that leverage emerging technologies in machine learning to manage large datasets. Additionally, the study examined how combining these methods and theories can generate valuable insights. These insights are intended to guide leaders and participants as each navigate the ever-adapting institutional landscape. As this exploration concludes, it has become abundantly clear that the complexity paradigm matters.

The complexity paradigm matters because it enables us to capture and make sense of the intricacies and nuances of the real world. Rather than being satisfied with an application of the term *ceteris paribus,* knowing full well that by invoking the term we are no longer talking about the real world, visualizing institutional fields by visualizing whole corpuses allows us to sidestep reductionist approaches that seek to linearize complex systems. By analyzing whole corpuses, researchers can visualize the real world of complex systems to a much greater extent than was previously possible.

Complexity is the landscape upon which wicked problems arise, ebb and flow. From public education to criminal justice, from public health to economic instability, most of the modern problems we face are complex in nature. The ability to model, analyze, and predict the behavior of such systems in terms of changing conditions is essential for effective decision-making and problem-solving. Machine learning processes used within

the complexity paradigm offer the methodologies and tools to tackle these complex issues head-on.

Moreover, the complexity paradigm fosters interdisciplinary collaboration and encourages the synthesis of knowledge from various fields. It blurs the boundaries between traditional academic disciplines, allowing researchers to draw insights and approaches from diverse domains and to work with experts in the fields of unfamiliar corpuses. This interdisciplinary approach is essential for addressing complex issues that transcend the confines of any single discipline. It promotes a more comprehensive and integrated understanding of the world, leading to more effective solutions and innovations.

The complexity paradigm also challenges our fundamental worldview and reshapes our understanding of causality. It highlights the limitations of linear cause-and-effect thinking and emphasizes the importance of context, conditions, sustainability, and resilience. This shift in perspective invites a more humble and nuanced approach to understanding the world, acknowledging the uncertainty and unpredictability that often accompany complex systems. This change in mindset has profound implications for both research and society.

In society, the complexity paradigm has the potential to inform better policymaking, governance, and decision-making. As society faces increasingly complex and interconnected challenges, theory and methods for utilizing machine learning to visualize huge datasets can guide us in crafting more effective and adaptive strategies. These theory and methods can encourage a shift towards more flexible and dynamic approaches to respond to the ever-changing nature of complex systems.

The complexity paradigm matters because it enables leaders, practitioners and researchers to grapple with the complexities of wicked problems, to foster interdisciplinary collaboration. And, by reframing our understanding of causality, it empowers them to generate solutions and policies that can accommodate real transformational change. Embracing the complexity paradigm is not merely an academic pursuit; it is a practical necessity for addressing the complex problems of our time.

Part One Summary

Part One of this research established the theoretical foundations necessary to understand adaptive institutional topology theory well enough to expand on it in future research. Those foundations include the fundamental differences between a permanence-based paradigm and a persistence-based paradigm. The two are separated by fundamental assumptions and do not share a normal science. The questions that can be asked within each are different, boundaries are defined differently in each, and problems are defined differently in each. Research is guided by either one or the other.

The fundamental difference between the two paradigms is the reification process. The linear paradigm reifies the 'things' it works with as permanent, abstractions that define something close to a perfect state. The complexity paradigm reifies 'things' as dynamic patterns in time that tend to persist under the right conditions. In the traditional paradigm, users are working with planning, externalization, engineering and outcomes. Boundaries are clearly definable. Wherever boundaries are not clearly definable, the linear paradigm breaks down. This is clearly shown in the cases of anomalies.

Wicked problems are anomalies in the traditional paradigm where problems are defined by solutions and stable equilibrium is imagined to be possible. Wicked problems

are simply ‘the landscape’ under a complex adaptive systems view. Feedback is counterintuitive and impossible to predict under the traditional paradigm that treats boundaries as nearly absolute. In such a system, feedback is something to be engineered out of the system. In a complexity paradigm, feedback is just ‘the landscape’. In the traditional paradigm, system collapse is a failure to engineer well enough. In a complexity paradigm, system collapse is a failure *caused by* trying to engineer well enough.

By understanding values as functional mechanisms that translate signals into behavior, researchers can transform the complex abstractions of institutional theory into a tangible and measurable landscape. This approach makes the rich scholarship of institutional theory more accessible and practical for practitioners, moving beyond theoretical concepts that often require extensive background knowledge. Viewing institutions as realms infused with values, and the institutional field as a landscape where these values compete, allows us to visualize the entire field or at least segments of the field. This perspective highlights the ongoing competition of values over time, offering a dynamic view of social activity within institutions.

Part One concludes by using the paradigm of complexity to revisit our understanding of the anomalies that appear unsolvable within the traditional paradigm. Complex adaptive system landscapes make sense of those anomalies as features of the dynamic landscape. Within complexity, these features are no longer anomalies and the normal science used in the complexity paradigm is equipped to deal with their qualities.

Part Two Summary

In Part Two, taking inspiration from discourse analysis techniques developed by Phillips, et al. (2004) and the Narrative Policy Framework (NPF) developed by McBeth et

al. (2014), the hand coding framework, Narrative Value-Based Coding (NVBC) is presented as a novel schema developed within this research. NVBC compliments the process of pattern finding and discovery used in the machine learning tools of LDA topic modeling and sentiment analysis. NVBC delivers a logical connection between the machine generated models and the narratives found in the secondary data source. The result is a process designed to identify and visualize patterns as signals that define the field as well as values indicating what the field is disposed to do with those signals.

This research breaks with the traditional approach to institutional research by placing the institution in time. Institutional research is typically approached as a point in time. Although many studies involve comparing institutions at points in time, researchers still typically abstract the institution as a permanent thing that becomes reified in the construction of that 'thing' as it stood at that moment in time. However, institutions and their environments are dynamic. They evolve, are fluid, and largely depend upon the people inside of them to work.

Part Two describes the methods developed in this study to capture patterns in time, preserving the persistent nature of the object under investigation. This research used the machine learning tools of topic modeling and sentiment analysis in a novel combination to provide visualization of the patterns in time displayed over time. Employing close reading of selected articles and hand coding using NVBC complimented the understanding of the narrative, values, and context the visualizations represent.

LDAvis, a visualization produced using the results of the LDA topic model, helped to visualize the degree of connection between topics as a spatial coordinate map viewed

from above, the X and Y coordinates of a three-dimensional landscape (with sentiment analysis and NVBC providing the Z axis). The LDAvis visualization made connections between the topics, terms, and corpus as a whole easily identifiable.

Part Three Summary

In Part Three, the case study of the national discourse of the American, K-12 institutional field of education, captured in widely distributed newspapers during the period surrounding NCLB adoption and implementation, was developed. The research processes described in Part Two proved to be well suited for this job. LDA topic models clearly identified signals that agreed with the hand coding of selected articles using NVBC, and the hand coding contributed significantly to the sense-making process. These methods showed that the signals were easily and intimately tied to values.

Sentiment analysis also provided clear indications of values competing for legitimacy. The graphic representations of a term's sentiment over time provided clear indication of where to drill down into the data to develop richer understanding. A close read of the articles where those sentiments appeared provided individual narratives around the way a value is being presented over time. The results far exceeded my expectations.

In short, multiple ways to iterate between the model and the text were found. This resulted in a description of the field that has both breadth and depth and usable information. Values were able to be identified in both the model results and within the narrative in the text. The findings from the model and the text were both able to be related to a visual description of the field. The amount of data and information that was not considered in the scope of this study, but was produced by these models and awaits analysis, is immense.

The results of this study go beyond a proof of concept. The LDAvis, sentiment analysis, and topic modeling tools and NVBC offers a wide range of options to gain a more nuanced view of the structure of the landscape of competing values. The LDAvis tool also offers a first draft at visualizing the field as an attractor basin. Through the methods employed, the data was able to describe the actual turbulence of the period around the passage of NCLB as a landscape of values competing for legitimacy.

Perhaps the most interesting question for future study to emerge from this research is the potential to visualize institutional fields dynamically as three-dimensional attractor basins with topic clusters defining the x and y coordinates, and legitimacy, the strength of the values associated with a given set of signals, representing the z axis. The degree of change over time could be converted to vectors showing direction as well as speed of change.

Part Four Summary

In Part Four, this research explored how one can situate the complexity paradigm alongside the traditional paradigm for matters of practice and decision making. Part Four explored the potentials for a normal science rooted in a complexity paradigm - including complex systems management and addressing problems that originate in complexity.

This combination of theory and methods has important implications for research that exceeded my hopes. Managing for capacity or outputs is clearly and relatively easily differentiated from managing for resilience, sustainability, and transformation. The language of externalization, unintended consequences, and rigidity take on new meanings when placed within the content of complexity. In applying the AITT framework within a complexity paradigm, connecting the theory and practice to align with the axioms of

complexity, leadership has much to gain. Developing the ability to distinguish which paradigm is appropriate for any given set of goals and problems is a critical step in managing complex systems and nudging them toward more desirable states.

The complexity paradigm can provide a new way to look at the environment for leaders who want to focus on resilience, sustainability, and transformation and/or who discover themselves trying to make decisions from within the tangle of a wicked problem. The methodology presented here, composed of theory, methods, and implications for practices situated in a complexity paradigm offer this guidance. Theory is how leaders can frame and articulate the issues and 'solutions' available in a given context. And methodology is how to identify those issues and 'solutions'. Understanding what the system is disposed to do through the empirical evidence offered by machine learning models can guide transformative change while minimizing surprises that build up as externalized feedback and threaten to overwhelm or collapse aspects of the system.

Significance:

The significance of this research first and foremost is that measuring and modeling the institutional field is indeed possible with the tools already at our disposal. Utilizing AITT with the current tools available, it is already possible to produce visualizations that can inform even non-experts of the analysis promised by some of the most complicated and theoretical elements of institutional theory. Although still in its early stages, this research has already accomplished that promise by measuring and visualizing a case study sample of an institutional field.

Beyond the success of the process as a proof of concept, this research has several other important points of significance. Many institutionally oriented questions of social

justice, race, inequality, prejudice, and bias are available for investigation directly within the same processed topic models and corpus datasets that are drawn for any other purpose. Observers can literally visualize the signals being processed and the values being institutionalized regardless of political rhetoric, denials, or distractions.

This illustrates the importance of corpus selection and corpus availability. While it may be possible to flood a particular corpus with propaganda, it is impossible to do so with all corpuses. Professional journals are written by and for practitioners in a field. Academic journals are written by and for academics studying particular subjects. Transcripts from public hearings or courtroom testimony capture the voices of engaged parties. And filtering of known bot or propaganda sources is possible as part of a corpus selection. In fact, coupled with geographic data, it should be possible to track the spread of a value or a propaganda talking point from its source or sources and identify permutations and alternative framings in close to real time.

Part One of this research addresses propositions about values that extend well beyond mere modifications to rational choice theory. Traditionally, rational choice theory operates on the premise that understanding people's desires allows economists to predict their actions, based on the assumption that both people and organizations aim to maximize utility. Over the years, notable thinkers like Herbert Simon (1955) have introduced amendments to this theory. However, even these revised theories treat values as permanent, fixed, and immutable entities. As a result, many models based on rational choice theory struggle to accommodate the dynamic nature of group values.

The issue isn't that economists and political scientists are unaware of the fluidity of values over time. Rather, the challenge lies in the construction of predictive models which necessitates simplifying complexity. For these models to be predictive and yield clear results, a degree of permanence and stability must be assumed. This requirement means that unpredictable elements, akin to the 'butterfly effect,' are typically engineered out from these systems to maintain interpretability and coherence in the models.

It is recognized that the propositions about value as a mechanism for converting information into action as put forth in Part One are incredibly far reaching given the power of AITT to identify, measure and model those values. Given the potential scope and significance of the potential applications of AITT which include the propositions about value, these propositions could benefit from multi-disciplinary collaboration aimed at refining the list based on what can be done with it.

Theoretical considerations aside, AITT and the methods employed in this research have immediate practical applications for future research. With these tools, researchers can create a picture, a visualization, distilling complex patterns into easily digestible images. The fact that practitioners, using the results of this approach, can show someone a picture and have a conversation, in itself, has tremendous utility.

The following lists include suggestions for future research using AITT and the methods producing visualizations of the institutional field. The lists are organized by headings: Future Research Possibilities Using Existing Dataset; Future Research Directions in Institutional Analysis Using Machine Learning; and Future Research Directions for Visualizing Institutional Fields.

Future Research Possibilities Using Existing Dataset

1. **Tracking Institutionalization of Values:**
    a. Investigate how specific values evolve and become institutionalized over time. This would involve tracking a value's journey through various stages of acceptance and integration within the institutional landscape.
2. **Analyzing Neutral Sentiments:**
    a. Incorporate the analysis of neutral sentiment scores in evaluating terms. This approach could uncover the "taken for granted" aspects of institutions as holders of values.
3. **Deeper Dive into Specific Topics - Case Study on 'Race':**
    a. Revisit the model outputs to conduct an in-depth analysis of specific topics, such as Topic 9 labeled ‘Race’. Examine how the narrative around ‘Race’ has shifted in its relation to other topics, its proximity, and its prominence within the institutional landscape.
4. **Incorporating Diverse Methodologies:**
    a. Enhance the research methodology by integrating additional technologies:
        i. **Geographical Information Systems (GIS)**: Introduce a spatial dimension to the analysis, providing a geographic perspective to the institutional field.
        ii. **Social Network Analysis (SNA)**: Apply a values-based approach to SNA and map the resulting networks onto the institutional landscape, offering insights into how values influence social connections and structures.
        iii. **Word2Vec**: Utilize Word2Vec for modeling the semantic relationships between words in the corpus. This method employs neural network techniques to understand word associations and nuances, which can reveal underlying patterns and connections within the discourse. By applying Word2Vec, the research can uncover how different terms and concepts are contextually linked in

the narrative about institutions, providing a deeper understanding of the linguistic structure and thematic development in the institutional landscape.

Future Research Directions in Institutional Analysis Using Machine Learning

1. **Multidimensional Institutional Analysis**:
    a. Explore institutions operating across various jurisdictions, scales, and sectors. Generate datasets that capture these different dimensions to model the complexity of institutional fields.
2. **Diverse Data Source Exploration:**
    a. Utilize various data sources like public written testimonies from the Loudoun County School Board meetings. Expand this approach to include federal, state, and local legislation, policy transcriptions, government reports, academic literature, video transcripts, promotional materials, and reports from philanthropic organizations, nonprofits, and professional associations. This diversity in data sources can provide a holistic view of institutional discourse.
3. **Tailoring Datasets for Organizational-Level Values and Profession-Specific Discourse:**
    a. **Organizational-Level Data Customization:**
        i. Develop datasets focused on capturing values at various organizational levels, such as individual schools, school districts, and state education systems. For each level, data can be curated to reflect the unique values and priorities at that scale. For instance, individual school data might focus on internal policies, community engagement, and specific educational practices, while district-level data might encompass broader policy implementations and district-wide initiatives. At the state level, the focus can shift to legislative actions, state-wide educational standards, and broader systemic changes.

b. **Profession-Centric Discourse Analysis:**
    i. Create datasets that specifically capture the discourse pertaining to certain professional roles within the educational field. For example, compiling data on topics discussed by superintendents can shed light on the leadership perspectives within education. These datasets can include transcripts from superintendent meetings, public speeches, policy documents they author or endorse, and media interviews. Analyzing this data can reveal insights into the leadership values, challenges faced by superintendents, and their approaches to education management and reform.

4. **Examining Institutional Mechanisms:**
    i. Investigate the impact of different institutional mechanisms such as policies, professional standards, best practices, expert opinions, philanthropy, nonprofit collaboration, academic research, and budget narratives. Analyze how these mechanisms shape and influence the institutional field.
5. **Sector-Based Analysis with Social Media Data:**
    i. Focus on the national discourse sector but incorporate social media data. Examine how quickly values propagate through social media compared to traditional news channels of discourse. Investigate if social media leads to different thresholds of acceptance and legitimacy.
6. **Temporal Dynamics in Institutional Fields:**
    i. Employ time-series analysis to understand how values and narratives evolve over time within institutions. This could involve tracking how specific policies or educational standards change in public discourse over the years.
7. **Comparative Analysis of National vs. Local Discourse Dynamics:**
    i. Conduct a comparative study of national and local-level discourses, focusing on the entry points and origins of specific topics and

narratives. Investigate the inception of certain ideas within the narrative: at what level do they emerge, and who are the key influencers? This analysis can also track how ideas and narratives spread across different levels. For instance, examine if there is a distinct narrative being introduced in school board meetings that originates from certain high-leverage districts. Determine what characterizes these districts as high-leverage or influential, and how they play a pivotal role in catalyzing specific narratives. This approach would provide valuable insights into the mechanisms of idea propagation and narrative influence in educational discourse.

8. **Cross-Institutional Comparative Studies:**
    i. Compare different institutions or sectors (e.g., education vs. healthcare) to understand how values are differently manifested and operationalized across institutional landscapes.
9. **Values and Sentiment Dynamics in Crisis Situations:**
    i. Analyze how institutional narratives and values shift during crises or major policy changes, using sentiment analysis to gauge the public and institutional response.

Future Research Directions for Visualizing Institutional Fields

1. **Interactive Three-Dimensional Landscape Visualization:**
    a. Create interactive three-dimensional visualizations of the institutional field. This would allow stakeholders to explore different dimensions of the landscape, such as policy effectiveness, public sentiment, or institutional influence, in a more immersive and engaging way. This approach could also expand to include using GIS when spatial boundaries matter.
2. **Mapping Value Evolution on the Landscape:**
    a. Use the institutional landscape model to trace the evolution of specific values within the institutional field. This can show how certain values gain prominence or lose relevance.

3. **Agent-Based Modeling on Fitness Landscapes:**
    a. Implement agent-based modeling to simulate how individual actors (like policymakers, educators, or activists) navigate the institutional landscape. This can provide insights into decision-making processes and strategy formation within the institutional field. In a similar way, it may be fruitful to implement cellular automata analysis to identify self-organized criticality in the system.

In our increasingly complex and interconnected society, the complexity paradigm offers significant insights for enhancing policymaking, governance, and decision-making. Utilizing machine learning to visualize large datasets, this approach guides the development of more effective and adaptive strategies, encouraging a shift towards flexible and dynamic responses to the nuances of complex systems. The products of these models, such as graphs and visualizations, not only bring new information to policy deliberations but also invite community engagement and participation. These visual tools can effectively represent the value-laden landscape of diverse community voices, aligning policy with community needs and beliefs, fostering inclusive decision-making, and establishing trust.

By making these visualizations accessible and interpretable to the general public, they serve as a powerful tool in social science and in leadership. They enable a dialogue on values that is crucial for conflict resolution, moral and ethical guidance in policymaking, and the sustainability of community initiatives. In essence, these models bridge the gap between complex data and community discourse, ensuring that governance is responsive, inclusive, and grounded in the values of the society it serves.

Conclusion

When we embrace complexity to inform a normal science, we can ask questions about resilience and sustainability with a higher level of integrity and substance than is possible under the assumptions of the traditional, linear paradigm. Leaders can use the results to understand the context of the landscape from within which they operate. And, because transformational leadership engages with the institutional field, the tools and methodology presented here can serve individual leaders who wish to see how their actions and behaviors affect the field itself. As reflective practitioners, leaders can discover if the values necessary to nudge the institutional field are, in fact, present in the field. With these tools, leaders can also see how their efforts are being received.

It is my hope that the theory and methodology presented here will add another voice to the chorus of those of us who are envisioning the possibilities, the dreams, and the hopes that our future grows into a more healthy, sustainable, and innovative ecosystem for all. And, especially in regard to the case study presented here, an ecosystem where our educational system can operate with the goal of improving the conditions for teaching and learning rather than installing units of education onto the parts of the machine we call children.

As a concluding statement, I would like this research to end with a pause. Take a moment. Consider a quote that has become a platitude in most cases and is usually summarized as “You can’t step in the same river twice.” The actual quote, from the Greek philosopher Heraclitus, reads, “No man ever steps in the same river twice, for it's not the same river and he's not the same man.”

It’s not just the river that isn’t the same, it’s everything.

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Appendices

The material contained within the appendices are meant to supplement this thesis. The files provide additional data and results used in this research. The supplemental files are provided with this document.

Appendix A: Model Scripts

The supplemental file containing the model scripts is provided with this document in a .zip file named “model_scripts.zip” (12 kB). To unpack this archive, simply right click on the .zip file and choose “Extract All”. The .zip folder contains two files: “Final_Sentiment_Analysis_Notebook_Export.ipynb” (14 kB) and “Final_Topic_Model_50_Export.ipynb” (18 kB).

Sentiment Analysis Model Script : The supplemental file containing the sentiment analysis script is provided with this document in a zip file named “model_scripts.zip” (12 kB). To unpack this archive, simply right click on the .zip file and choose “Extract All”. The .zip folder contains a .ipynb file named “Final_Sentiment_Analysis_Notebook_Export.ipynb” (14 kB). The .ipynb file, which is a Jupyter Notebook file, requires a Python environment to run. This can be a standard Python installation or a virtual environment with the necessary dependencies installed.

This Jupyter Notebook contains a script that has been compiled from two different sources for reference purposes. The combination of notebooks caused inconsistencies in variable names. As a result, the script, in its current form, will not execute error-free if run as-is.

Topic Model Script: The supplemental file containing the topic model script is provided with this document in a zip file named “model_scripts.zip” (12 kB). To unpack this archive, simply right click on the .zip file and choose “Extract All”. The .zip folder contains a .ipynb file named “Final_Topic_Model_50_Export.ipynb” (18 kB). The .ipynb file, which is a

Jupyter Notebook file, requires a Python environment to run. This can be a standard Python installation or a virtual environment with the necessary dependencies installed.

This Jupyter Notebook contains a script that has been compiled from two different sources for reference purposes. The combination of notebooks caused inconsistencies in variable names. As a result, the script, in its current form, will not execute error-free if run as-is.

Appendix B: LDAvis Animated Graphic of Full Corpus, 50 Topic Model

The supplemental file containing the LDAvis animated graphic of the full corpus, 50 topic model is provided with this document in a .zip file named "last_visualization.zip" (967 kB). To unpack this archive, simply right click on the .zip file and choose "Extract All". The .zip folder contains two files: "Topic_Modeling_Visualization_Final_50.json" (1,900 kB) and "Topic_Modeling_Visualization_Final_50.html" (1,900 kB).

To view the output of LDAvis, both the .json and the .html files need to be saved to your computer. The .json file contains the data, while the .html file is used for display. To open and view the LDAvis visualization, simply open the .html file with a web browser. The browser will render the visualization using the data from the .json file.

Appendix C: Top Weighted Words for 35, 50, 100 Topic Size

The supplemental file containing the top 10 most highly weighted words for the topic sizes of 35, 50, 100 topics is provided with this document in a file named “topic_weights_words_35_50_100_sample.xlsx” (45 kB). The .xlsx file is an Excel 2007+ format file and can be read using the Microsoft Excel software, Google Sheets, or other compatible spreadsheet software. The file can also be read into a DataFrame using the Pandas library in Python.

The topics in these models (35, 50, 100 topic size) were created from a random sample of 10,000 articles drawn from the full corpus of 37,186 articles. In the spreadsheet, the columns list the topic number, the normalized sum probability of the topic as it relates to the corpus, and the 10 most highly weighted words in decreasing order.

Appendix D: Corpus Metadata

The supplemental file of the corpus metadata is not uploaded with this document and is only available from the author upon request. The information contained in the corpus metadata file is the metadata for the full corpus of 37,187 article used in this research.

Appendix E: Stop Words and Entities

The supplemental file containing the Stop Words and Entities is provided with this document in a .zip file named "stop_word_entities.zip" (32 kB). To unpack this archive, simply right click on the .zip file and choose "Extract All". The .zip folder contains two files: "stopwords.docx" (20 kB) and "List_of_Entities_test.csv" (31 kB).

Stop Word List: The supplemental file containing the stop used in the topic modeling script is provided with this document in a zip file named "stop_word_entities.zip." (32 kB). To unpack this archive, simply right click on the .zip file and choose "Extract All". The .zip folder contains a .docx file named "stopwords.docx" (20 kB). The .docx is the file format used by Microsoft Word 2007 and later versions. The .docx file can be opened with Microsoft Word, Google docs, or any other compatible word processing program.

List of Entities: This supplemental file is a list of 'Entities' that appear in the full corpus of 37,186 articles. The list of entities was an output from the sentiment analysis model. The file is provided with this document in a zip file named "stop_word_entities.zip" (32 kB). To unpack this archive, simply right click on the .zip file and choose "Extract All". The .zip folder contains a .csv file named "List_of_Entities_test.csv" (31 kB). The Comma-Separated Values file or .csv file can be read into a DataFrame using the Pandas library in Python or imported into an Excel spreadsheet, Google Sheet, or a spreadsheet program supporting this file type.

Appendix F: Topic Information

The supplemental file containing the topic information is provided with this document in a .zip file named "topic_information.zip" (6700 kB). To unpack this archive, simply right click on the .zip file and choose "Extract All". The .zip folder contains three files: "topic_modeling_dates_final_50.csv" (41,400 kB), "topic_modeling_words_final_50.csv" (3,700 kB), and "Doc_NormWeight_Topic.xlsx" (26 kB).

Topics with Associated Article Weights: This supplemental file is an output of the topic model with 50 topics and the full corpus used in the final analysis. The file is provided with this document in a zip file named "topic_information.zip" (6,700 kB). To unpack this archive, simply right click on the .zip file and choose "Extract All". The .zip folder contains a .csv file named "topic_modeling_dates_final_50.csv" (41,400 kB).

The Comma-Separated Values file or .csv file can be read into a DataFrame using the Pandas library in Python or imported into an Excel spreadsheet, Google Sheet, or a spreadsheet program supporting this file type.

The columns are displayed in the following order: date of the article, topic numbers (0-49), goid or unique article identification number. The goid in the last column represents the article data in that row.

Topics with Associated Word Weights: This supplemental file is an output of the topic model with 50 topics and the full corpus used in the final analysis. The file is provided with this document in a zip file named "topic_information.zip" (6,700 kB). To unpack this archive, simply right click on

the .zip file and choose “Extract All”. The .zip folder contains a .csv file named “topic_modeling_words_final_50.csv” (3,700 kB). The Comma-Separated Values file or .csv file can be read into a DataFrame using the Pandas library in Python or imported into an Excel spreadsheet, Google Sheet, or a spreadsheet program supporting this file type.

The columns in this document are displayed with the topic number in the first column. This is followed by the words that were used in the LDA processing. The words appear in alphabetical order. Each word lists the associated topic weight for the topic in that row.

Top 5 Most Heavily Weighted Articles per Topic: The supplemental file containing the spreadsheet of the top 5 most heavily weighted articles per topic is found in the .zip file named “topic_information.zip” (6,700 kB). To unpack this archive, simply right click on the .zip file and choose “Extract All”. The .zip folder contains a .xlsx file named “Doc_NormWeight_Topic.xlsx” (26 kB). The .xlsx file is an Excel 2007+ format file and can be read using the Microsoft Excel software, Google Sheets, or other compatible spreadsheet software. The file can also be read into a DataFrame using the Pandas library in Python.

The spreadsheet columns include topic number, document id (goid), and normalized weight of the article within the topic.

Appendix G: Narrative Value-Based Coding Data Table

The supplemental file containing the spreadsheet of coding using the Narrative Value-Based Coding Schema is provided in a .xlsx format named "NVBC_results.xlsx" (87 kB). The .xlsx file is an Excel 2007+ format file and can be read using the Microsoft Excel software, Google Sheets, or other compatible spreadsheet software. The file can also be read into a DataFrame using the Pandas library in Python.

Appendix H: Topic Graphs and Sentiment Analysis Graphs

The supplemental file containing the topic information is provided with this document in a .zip file named “graphs.zip” (2,900 kB). To unpack this archive, simply right click on the .zip file and choose “Extract All”. The .zip folder contains two files: “all_topics_over_time_normalized.pdf” (92 kB) and “Sentiment_Analysis_Graph_full_corpus_final.pdf” (3,700 kB).

Graphical Representations of All 50 Topics from the Topic Model: The supplemental file containing the graphs of all 50 topics used in the final analysis is provided with this document in a zip file named “graphs.zip” (2,900 kB). To unpack this archive, simply right click on the .zip file and choose “Extract All”. The .zip folder contains a .pdf file named “all_topics_over_time_normalized.pdf” (92 kB). A .pdf file (Portable Document Format) can be opened using a wide variety of software across different platforms. This file can open in web browser such as Mozilla Firefox or Google Chrome, or software such as Adobe Acrobat Reader.

Sentiment Analysis Graphs: This supplemental file contains the sentiment analysis graphs produced for specific terms. The file is provided with this document in a zip file named “graphs.zip” (2,900 kB). To unpack this archive, simply right click on the .zip file and choose “Extract All”. The .zip folder contains a .pdf file named.pdf file named “Sentiment_Analysis_Graph_full_corpus_final.pdf” (3,799 kB). A .pdf file (Portable Document Format) can be opened using a wide variety of software across different platforms. This file can open in web browser such as Mozilla

Firefox or Google Chrome, or software such as Adobe Acrobat Reader.

Appendix I: LDAvis Animated Graphic of Corpus for Topic 0

The supplemental file containing the LDAvis animated graphic of the full corpus, 50 topic model is provided with this document in a .zip file named "topic0_lda.zip" (605 kB). To unpack this archive, simply right click on the .zip file and choose "Extract All". The .zip folder contains two files: "Topic_Modeling_Visualization_Final_Topic0.html" (1,200 kB) and "Topic_Modeling_Visualization_Final_Topic0.json" (1,200 kB).

To view the output of LDAvis, both the .json and the .html files need to be saved to your computer. The .json file contains the data, while the .html file is used for display. To open and view the LDAvis visualization, simply open the .html file with a web browser. The browser will render the visualization using the data from the .json file.