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Understanding and Managing Change in Educational Organizations

Eğitim Örgütlerinde Değişimi Anlamak ve Yönetmek

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ABSTRACT

The deterministic perspective, which views contemporary educational organizations as classical cause-and-effect systems that can be easily controlled and digitized, no longer provides the necessary support and solutions to these organizations and their problems. Instead, the validity of complexity and chaos theory has emerged, which considers educational organizations as dynamic and complex systems and acknowledges that although many things are unpredictable, there is a certain order and even seemingly insignificant factors can have significant consequences. Therefore, evaluating the management of change in educational organizations from the perspective of these theories will provide an advantage in exploring the nature of change and managing it successfully. In this paper, after discussing change and management as an inevitable phenomenon, the paradigm shift mentioned above was explained. Subsequently, chaos theory was examined, and the applications of the theory in the context of managing change in educational organizations were discussed.

Keywords: Change, change management, chaos and complexity theory, self-organization, organizational change

ÖZ

Günümüz eğitim örgütlerini kolaylıkla kontrol edilebilen ve sayısallaştırılabilen klasik neden-sonuç sistemleri olarak gören deterministik bakış açısı, artık bu örgütlere ve sorunlarına gereken desteği ve çözümleri sunamamaktadır. Bunun yerine, eğitim örgütlerini dinamik ve karmaşık sistemler olarak kabul eden ve çoğu şeyin tahmin edilemez olmasına rağmen belirli bir düzene sahip olduğu ve önemsiz görünen şeylerin bile çok önemli sonuçlar doğurabileceği anlayışını veren karmaşıklık ve kaos kuramı geçerlilik kazanmıştır. Dolayısıyla, değişimin yönetimine ilişkin eğitim örgütlerinin bu kuramların perspektifinden değerlendirilmesi hem değişimin doğasının keşfedilmesinde hem de başarılı bir şekilde yönetilmesinde avantaj kazandıracaktır. Bu çalışmada, öncelikle kaçınılmaz bir olgu olarak değişim ve yönetimi tartışıldıktan sonra yukarıda sözü edilen paradigma değişimi açıklanmıştır. Sonrasında ise kaos kuramı irdelenerek eğitim örgütlerindeki değişimin yönetimi bağlamında kuramın uygulamaları tartışılmıştır.

Anahtar Kelimeler: Değişim, değişim yönetimi, kaos ve karmaşıklık kuramı, kendi kendini örgütleme, örgütsel değişme

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Introduction

We are encountering many new situations today, whether achieved or unexpected, by humanity. As Hargreaves (2002) stated, " We live in a world of endless and relentless change... and it challenges us to come to terms with and master new knowledge, skills and experiences"(p.189). Change is considered “one of the oldest known realities of humanity” (Şen & Batı, 2020, p. 76). The quote by the Greek philosopher Heraclitus, "The only constant in life is change," has been widely embraced to the extent that questioning change is no longer common. Moreover, factors such as technological advancements, increasing diversity in human needs, and heightened awareness levels among individuals have accelerated and necessitated change.

Although change is sometimes perceived as a threat and sometimes as an opportunity for organizations, unfortunately, most modern organizations often fail to achieve sustainable and effective change (Lewis, 2019; Stouten vd., 2018; Vakola, 2014; Van Tonder, 2004). Relevant research indicates that managers believe only one of the planned three organizational change interventions is genuinely successful (Meaney & Pung, 2008, cited in Armenakis & Harris, 2009). In the United Kingdom, only 38% of managers think that the change in their organizations is successful (Holbeche, 2006, cited in Stouten et al., 2018). Similar perceptions about changes in educational organizations are observed in studies conducted in our country (Kondakçı et. al. 2019; Toprak, 2018). On the other hand, despite the conceptual and theoretical accumulation, the question of how to achieve successful change in educational organizations is the most significant concern for scholars and practitioners because most interventions either have not reached their goals or have not been implemented at all (Acton, 2021; Cheng & Walker, 2008; Kondakçı et. al., 2019; Toprak, 2018). Research on change in educational organizations has yielded the following results:

- It is consistently top-down (Hoşgörür, 2016; Toprak, 2018);
- It creates conflicts with stakeholders when implemented rapidly (Toprak, 2018).
- It is unprepared and not consulted with practitioners (Demiral, 2014).
- Focus is placed on macro-level aspects without being aware of the complexity of change and without examining the micro-level dynamics (Kondakçı et al., 2019).
- School administrators have limited authority in the change process (Hoşgörür, 2016).
- In the minds and memories of teachers, the failure of change has gradually become a phenomenon (Hargreaves, 2002).
- Sustainability has not been achieved (Hargreaves, 2002).
- There is a lack of a collaborative learning culture, and the lessons to be learned have not been fully embraced. A change system focused on top-down, bottom-up, and horizontal improvements and innovations has not been established (Fullan, 2016).
- The role defined for teachers, who are the key factor in education, is passive, and there is insufficient space, time, and environment to influence government policies regarding the benefits teachers provide to students (Shirley & MacDonald, 2016, cited in Kondakçı et al., 2019).
- In planned change, the stable vision for the future, and in particular, the development of plans by those responsible for change in public institutions based on limited information and material resources, has led to poorly designed and unclear or unrealistic goals (Hargreaves, 2002).
- The change process has not been understood (Acton, 2021).

When examining these results, it can be said that the most important factor that makes the change efforts unsuccessful is the insufficient understanding of the nature of the change and the conditions requiring change. Factors that will give educational organizations an advantage in dealing with ongoing changes include knowing the nature and source of the continuous change phenomenon (Çobanoğlu, 2008) and better defining organizational change to increase the likelihood of success and reduce the negative consequences of unsuccessful changes on organizational members and stakeholders. However, it is also important to reconsider the paradigms we rely on when assessing situations. The ineffective management of uncertainties and crises, along with the inability to accurately identify the source, may be attributed to many situations being approached with linear (Newtonian) methods rather than the complexity paradigm.

In today's world, complexity science and chaos theory have begun to be utilized to explain the nature and origins of the phenomenon of change. Understanding chaos theory and complexity sciences is crucial for the systematic transformation of education systems to better meet the rapidly changing needs of society and children. Furthermore, it can help in understanding when existing education systems might be ready for transformation, what system dynamics might influence changes once transformation begins, and how the changes made might

impact the system. Moreover, chaos theory and complexity sciences can assist in understanding and enhancing the transformation process itself, which is a complex system utilized by education systems to transform themselves (Reigeluth, 2004).

It is believed that this study will shed light on reviewing the paradigms used as references for evaluating changing situations and understanding the current changes. Additionally, it is considered important for education organizations to develop a different perspective and effectively manage the phenomenon of continuous change with the assistance of complexity science and chaos theory. Therefore, the aim of this study is to present a conceptual framework for the explanation of the dynamics of change through complexity science and chaos theory, drawing from both international literature and previous research (e.g., Akmansoy & Kartal, 2014; Altun, 2001; Çobanoğlu, 2008; Ertürk, 2012; Gürel, 2018). Subsequently, the development of a framework for applications in educational organizations is aimed. The comprehensive research question guiding the study can be presented as follows: Can complexity science and chaos theory provide insights that facilitate the exploration and management of the nature and source of change in educational organizations, and can they serve as a guide in managing change? This article will address two auxiliary research questions: i) What is the change in the paradigm based on the examination and analysis of the literature? ii) What is chaos theory, and how does it explain change?

Methods

The information presented in this review provides a general overview of complexity science and chaos theory, offering a different perspective on the nature and management of change for educational organizations. Therefore, it is designed as a "traditional review," where previous studies on a specific topic are gathered and interpreted, and their conclusions and evaluations are synthesized (Torgerson et al., 2017, p.357). Peer-reviewed articles and books on "Organizational change" and "Complexity science and chaos theory" were accessed through the electronic resources of the author's university library. Studies containing keywords such as "change," "organizational change," "organizational change in educational organizations," "complexity science," "chaos theory," "chaos in educational organizations," and "chaos in educational management" were searched for. Inclusion criteria for the study scope included being "written in English or Turkish," "accessible in full text or abstract," and "being an academic study regardless of its type and publication year." The author determined the suitability of the study by reading the title, abstract, and full text if available. Searches containing combinations of the identified keywords and related concepts were continued until the author believed saturation was achieved.

Organizational Change

According to Lewis (2019), change is "something we sometimes seek, sometimes resist, and often have thrust upon us" (p. 1). While change is defined in its simplest terms as "moving from one level to another," it also encompasses situations where "the places of individuals and objects are altered, and personal knowledge, skills, and abilities are placed in a different position than the current situation" (Kerman & Öztop, 2014; Tunçer, 2013). This shift to a different level or position, whether planned or unplanned, can occur in the desired direction or an undesirable one.

The phenomenon of change, which progressed at a slow pace worldwide until the Industrial Revolution, gained momentum after the revolution. Especially with the developments in information technologies in the 1990s, it accelerated, affecting not only societal and individual lives but also organizational life. Just as individuals are compelled to adapt their social and private lives to uncertain situations, all open-system organizations must be sensitive to the uncertainties and changes occurring in their environments and respond dynamically (Kerman and Öztop, 2014). Indeed, extraordinary circumstances such as the recent pandemic have necessitated many changes, particularly in the structure and functioning of work (Almaz, 2022, p. 339; Öge & Çetin, 2020, p. 7; Serinikli, 2021, p. 278; Şen & Batı, 2020, p. 76). Therefore, for today's organizations, the emphasis appears to be more on how to manage change rather than its necessity.

The mentioned organizational change involves the transformation of an organization from one point to another. Kanter (1992) explained change as an event, describing the movement of an organization from " “state 1 at time 1" to "state 2 at time 2."(p. 9). Moran & Brightman (2000, cited in Eroğlu & Alga, 2019) argue that organizational change is (1) non-linear, and therefore, the beginning and end cannot be clearly defined; (2) effective change involves the integration of multiple improvement efforts; (3) occurs both top-down and bottom-up; and (4) measurement of goals is a key element for success and sustainability.

Organizational change, although a prominent and enduring topic in management (Alkaya & Hepaktan, 2003; Suddaby &

Foster, 2017), is criticized for its weakness when it comes to how the change is managed, due to factors such as the undefined nature of change and its epistemological status being left "unexamined" (Suddaby & Foster, 2017), and the lack of a common understanding in the scientific literature on basic change processes (Stouten et. al., 2018; Van Tonder, 2004). As a result, the following fundamental questions about change often remain unanswered (Suddaby & Foster, 2017, p.1): "How can we know when change has been successfully implemented?", "How do we distinguish change from stability?", "Where do we look for change in complex organizations?" and perhaps most importantly, "What do we mean when we say the organization has changed?"

Change is sometimes seen as an "inevitable phenomenon that constantly creates organizational problems and makes finding solutions mandatory" (Çobanoğlu, 2008). However, considering it as a problem is not entirely incorrect. Numerous studies (Bamberger et al., 2012; Dahl, 2011; Ferrie et al., 1998; Loretto et. al., 2010) show that exposure to organizational change increases the risk of various health problems. Understanding the process of change can also be challenging and frustrating for leaders because it requires them to consider factors they may not want to deal with (Fullan et al., 2005, p. 55). However, it is essential not always to perceive change as a problem but also as an opportunity. According to Lewis (2019), change can be a way to overcome many significant problems related to politics, governance, the rule of law, philosophy, and the distribution of rights and resources that closely concern societies, organizations, and individuals. It is also related to productivity, effectiveness, quality, competitiveness, creating common values, understanding, and collaboration. Change should be considered as a response to some important threats or opportunities that occur outside the organization (Alkaya & Hepaktan, 2003). Organizational change refers to intentional and planned change initiatives aimed at improving organizational performance or development in a changing context (Wang et al., 2023, p. 1040).

The Shifting Paradigm and Complexity

Newton's three fundamental laws of classical physics, based on the hypothesis that "certain effects will occur in response to certain causes" and "everything that happens can be precisely measured" and "given certain effects to the system, certain reactions will occur," have become a dominant paradigm, especially known as the law of action and reaction, and it has become widespread in many fields, including governance (Ertürk, 2012). Karacay (2004), explaining that the essence of Newton's laws is based on determinism, describes determinism as "the present state of a physical system is the result of its previous state":

> ...it is possible to determine every event and motion in advance. According to Newton's laws of motion, just as the current event and motion arise from the previous event and motion, the future event or motion will also be the result of the current event or motion. From the perspective of a classical physicist, being able to predict with absolute certainty that Halley's comet will revisit Earth in the year 2061, or to accurately calculate when the next solar eclipse will occur and from where on Earth it will be best visible, is an undeniable triumph of determinism. This view, which has been the foundation of modern science for 400 years, has created the science, technology, and civilization we find ourselves in today.

However, the "quantum physics theory" proposed in the early 1900s, which has had significant impacts on the development of management science (Bayramoğlu, 2016), began to gain more acceptance by providing answers to many unanswered questions left by the Newtonian paradigm (Ertürk, 2012). Emphasizing that the future of systems is unpredictable and uncertain, the complexity paradigm has replaced the old paradigm and is considered the fundamental paradigm for contemporary organizational theories.

Today's new paradigm indicates another aspect where non-linearity, chaos, complexity, and uncertainty are considered normal (Erçetin, 2001). It is almost impossible to assess organizational activities definitively, and assuming linearity and predictability does not seem very reasonable (Çakar & Alakavuklar, 2013). Therefore, the complexity of political, regulatory, and technological changes faced by most organizations puts pressure on them to adapt to these changes, even to make radical changes (Greenwood & Hinings, 1996), and to have competitive, flexible, and more adaptable structures (Arévalo & Espinosa, 2015). The strong criticisms of the traditional paradigm based on organizational theory and the ineffectiveness of associated hierarchical control have led to the examination of social organizations as complex systems (Arévalo & Espinosa, 2015). The paradigm shifts mentioned in Figure 1 are illustrated.

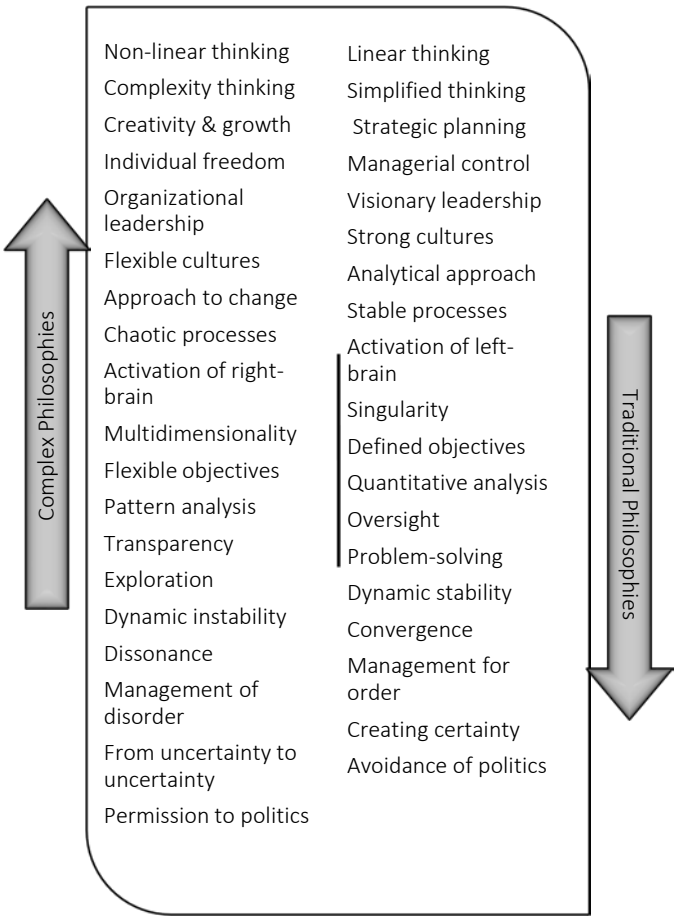

Figure 1.
Paradigm Shifts in Management Philosophies and Practices (Singh & Singh, 2002)

The subject of complexity, although gaining importance in recent years, has deep historical roots. Early works such as Adam Smith's "Invisible Hand," Von Neumann's "Self-Reproducing Automata," and Darwin's "Theory of Evolution" have inspired some of the earliest theories about complex systems and self-organization. While the idea of complex systems has been used to describe a wide range of chemical, physical, biological, technological, and social phenomena, there is still no consensus on what constitutes a complex system or its characteristics (Arévalo & Espinosa, 2015). Some researchers do not consider complexity science as a discipline but rather define it as an "interdisciplinary field" shared by researchers with the same view (Vigni, 2020).

Chaos Science and Chaos Theory

Although chaos is originally a philosophical concept dating back to ancient times, it has been neglected by scientists attempting to view situations without linear relationships through a positivist perspective over the past two centuries; propositions or systems that are chaotic have been avoided (Altun, 2001). However, in Chaos Theory and parallel to it, in complexity theory, the presence of nonlinear relationships in complex systems (organizations) that can create unexpected and unpredictable outcomes is emphasized (Töremen, 2000). The reasons for the inability to make predictions for most of these "nonlinear" dynamic systems (Karaçay, 2004) are the lack of analytical solutions for these systems; the inability to precisely determine any initial condition (The Principle of Uncertainty in Measurement) and the sensitivity to initial conditions, where even very small changes in the initial conditions of the system can lead to very large differences (Sensitive dependence on initial conditions- the Butterfly Effect).

Chaos, derived from the physical and mathematical sciences, is defined as "irregular, unpredictable behavior occurring in an extremely sensitive system to changes in initial conditions" (Singh & Singh, 2002). Dynamic systems with unpredictable behaviors or the behaviors of these systems are referred to as chaos (Karaçay, 2004). The "irregularity" in these definitions of chaos is not simply a disorder or chaos in a straightforward sense. Describing disorder in this way will make chaos and the opposite of chaos, order, more incomprehensible. Order and disorder can have many different interpretations (Öge, 2005). If considered as two extremes, Erçetin et al. (2013) indicate that there are infinite possibilities for the chaotic and ordered states of any system. They also suggest that the definitions of chaos and order can vary depending on the system and the observer:

> If we take a particle as an example, it may not perceive its movements as chaotic from its own perspective, but an observer who observes the source of the particle's movement and other particles influencing it for a sufficient period of time may perceive the behavior of the particle as chaotic. Since the boundary between order and chaos is not clear, it is difficult to clearly determine the level of chaos of a system. Such a level should be defined for each system. Definitions like "more chaotic" or "less chaotic" valid for one system may not be valid when compared with another system. Comparing the chaos in the storage of information in the human brain with the chaos observed in changes in heart rhythm is probably impossible. It may be problematic to focus on the duration of observations in these comparisons because there may be unknowns outside the observed period.

Although chaos is generally considered a disorder, chaos theorists explain it with three different situations: (1) "stable equilibrium" where the balance is temporarily disturbed, and stability and balance can be restored in a short time, (2) "limited instability" or "chaos" where order and disorder coexist, and it is possible to predict how the system will behave despite unpredictable events and changes, and (3) "explosive instability" where there is no order and general

trends. Theorists believe that organizations are closer to "limited instability" or chaos rather than "stable equilibrium." If this is accepted, management approaches adopted during stable periods should be seriously changed. Organizations need to become places with more chaos and improve their management skills (Töremen, 2000).

Chaos means the existence of disorder and turbulence (Açıkalın & Bölücek, 2014). According to chaos researchers, when complex systems begin to lose their balance, they are pulled in different directions by powerful attractors[1], one of which dominates the others, making them insignificant (Töremen, 2000). Moreover, some of these attractors can pull the system into a balanced or near-balanced state, while others can force the system into an entirely new shape (Morgan 1998, p. 293). The most popular example related to the latter is the "Lorenz attractor".

> Lorenz used his computer to enter data and graphically display the temperature values he found to prepare a simple weather forecast. By randomly elevating the temperature values he had chosen, even in small proportions that the most sensitive thermometer could not detect, Lorenz expected that there would be no difference in the graphs when he ran the function again. However, he observed that entirely different functions emerged instead. He noticed that the ups and downs in the graph created a pattern like a butterfly in the long run (Öge, 2005).

As a result of the research conducted by meteorologist Edward Lorenz, who made a significant contribution to chaos theory, the shape known as the "Lorenz Attractor," resembling butterfly wings or owl eyes, emerged from the inadvertent elevation of temperature values (Figure 1). Attractive forces created this pattern or fractals[2] in the chaos theory literature. When examining the figure, it is understood that "every event that appears so complex has its own cause" (Turunç, 2008).

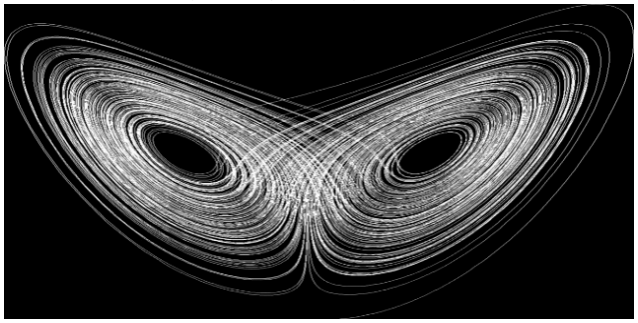

Figure 1.
Lorenz Attractor (Wilkinson, 1997)

This figure illustrates the "presence of a regular structure within irregular flow" and the idea that "the system never repeats itself, and the orbits do not intersect" (Demirkan, 2017). Based on this finding, Lorenz suggested that accurate, reliable, and long-term predictions about the weather were impossible due to chaotic behavior, as systems exhibiting non-periodic behavior make forecasting beyond a certain period unfeasible (Öge, 2005). Thus, Lorenz highlighted two interesting characteristics of chaotic systems, even though they may appear disorderly from the outside, there is an inherent order within them (Biçici, 2016; Öge, 2005; Turunç, 2008):

Sensitive Dependence on Initial Conditions

In chaos theory, it is explained through the metaphor of the "butterfly effect" that small changes in initial conditions can lead to significant and unpredictable differences in outcomes. According to Karaçay (2004), physicists have an interesting saying to describe this situation: "If a butterfly flaps its wings in China, it can cause a hurricane in Texas." Although the occurrence of this event may not seem very likely, what is intended to be conveyed here is that "like the flap of a butterfly's wings, a very small effect can trigger many small changes in a chain reaction, thus affecting the system, moving it away from the attractive element" (Çobanoğlu, 2008).

Henri Poincaré, the scientist who initially formulated chaos theory, asserted that even tiny differences in initial conditions would lead to significant differences in outcomes, making predictions impossible (Biçici, 2016). The event that made this possible was the resolution of the three-body problem in astronomy (where Newton's laws perfectly fit the motion of two celestial bodies, but analytical solutions cannot be obtained when there are more than two celestial bodies), which gained considerable attention in astronomy in the early 20th century, resolved by Henri Poincaré (Karaçay, 2004).

> In 1900, King Oscar II of Norway announced that he would reward anyone who could prove whether the solar system was stable. Henri Poincaré demonstrated in the same year that the solution to the system of equations determining the motion of the solar system was sensitive to initial conditions. He showed that, although the initial conditions could never be accurately determined, making it impossible to determine whether the solar system was stable. Poincaré was the first to use the term "chaos" for this unpredictable situation. Thus, Poincaré became the

[1] Attractor: Although events occurring in chaotic systems are often described as random, it is observed that there are some areas of concentration, called "attractors," in their mathematical representation. Attractor is defined as "a focal point within the system that attracts other structures of the system towards itself" (Kuşcu et al., 2020).

[2] Fractal: In a chaotic system, it is the "smallest subunits resembling each other and the whole" (Orhan, 2013). These structures are "geometric structures, numerous and resembling each other and the whole system, representing the entire system" (Kuşçu et al., 2020).

> recipient of the reward without solving the intended problem (p. 5).

Non-Randomness:

According to chaos theory, non-randomness implies that most events occurring in the world have a chaotic structure, and all chaotic structures have an inherent order within them. In other words, there is an "order within disorder." Examples of situations where chaos emerges include the swirling of cigarette smoke in helical patterns, the fluttering of a flag in the wind, the behavior of cars moving one after the other on a highway, or the dripping of water from a tap, initially falling at regular intervals but eventually losing its regularity (Öge, 2005). These chaotic structures, not conforming to the Newtonian scientific paradigm, also exhibit the characteristics of a dynamic process.

Self-organization (Otopoiesis)

Chaos theory teaches us that there is no system that can be considered correct, and unpredictability is inherent. Therefore, for organizations to sustain their existence as systems, they must be able to perceive changes occurring in their environment, undergo the necessary transformations, and manage chaos (Bayramoğlu, 2016; Çobanoğlu, 2008; Kurşunoğlu & Tanrıöğen, 2006). The chaotic environment in which systems find themselves already forces them to find new and creative ways to improve themselves.

As evident from the previous sections, chaos theory has its own vocabulary and metaphors. One of these metaphors is the concept of the "edge of chaos," fervently advocated by Kauffman. Through his research, Kauffman:

> …began to see that living systems operated at their most robust and efficient level in the narrow space between stability and disorder—poised at "the edge of chaos" It was here, it appeared, that the agents within a system conducted the fullest range of productive interactions and exchanged the greatest amount of useful information. People recognize this in everyday life: A slightly messy office is a productive one; rollicking families are happy; economies flourish under scant regulation. The edge of chaos, but not quite chaos itself. (cited in Lissack, 1999, p.114).

Chaos theorists have focused on events that lead systems to transform themselves, moving from a state of equilibrium to the edge of chaos. According to this theory, when systems (components) are taken out of balance and brought to the edge of chaos at an unpredictable time, they encounter various outcomes resembling bifurcations[3], branching into very different futures (see Figure 3). The system works to "self-organize effectively to escape from this chaos" through unpredictable defense mechanisms, thanks to both the energy it possesses and readiness for such situations. The initial influential "attractor" can eliminate potential changes and lead the system to a different variation of its initial state if it disperses the existing energy and instability. However, if the new "attractor" becomes more dominant, the energy it possesses can pull the system for reshaping (Morgan, 1998, p. 295; Yüksel & Esmer, 2019).

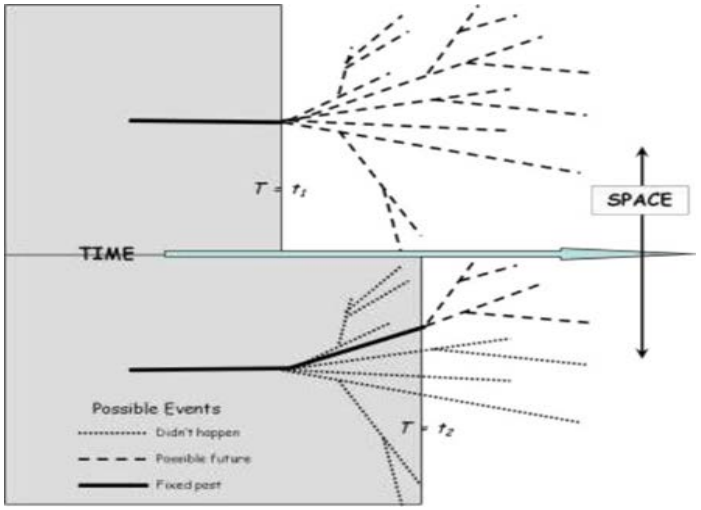

Figure 2.

Motion of a Particle Through Space and Time Where The Motion is Randomly Perturbed (Hall, 2013)

Figure 2 depicts the possible trajectories of a physical system at two points in time (t1 and t2) in the state-space where time progresses from left to right. The gray areas represent the block universe of past time, while the white area represents the yet undetermined future. The line separating the past and the future is the "now." Historical events located in the fixed past are represented by straight-thick lines. When now = t1, the possible futures reachable in the next moment are adjacent possible states represented by dashed lines. In our perceived universe, at any given moment, only one of the adjacent possible states available for that moment has actualized. At a later moment, when t2 is reached, it is observed that the possibilities that were once possible are no longer possible (Hall, 2013, p. 114).

[3] Bifurcation is the disruption of order. In a disaster, patterns of order are lost, individuals become confused, disoriented, and disillusioned. Thus, forking results in radical change, and thereafter, previous assumptions, methods, models, and relationships no longer function (Liska et al., 2012). Irreversible decisions are made at fork points (Erdoğan, 2012).

In turbulent[4] environments described above, the ability of systems to respond to environmental conditions by reproducing/changing their internal structures and/or functions solely relying on themselves is explained by the concept of self-organization (autopoiesis) (Çobanoğlu, 2008; Mbengue et al., 2018). Self-organization is defined as a form of organization where "the system as a whole produces, changes, and differentiates itself from its components" and was developed by two Chilean biologists, Humberto Maturana and Francisco Varela (1974). These two biologists argued that autopoiesis is the "definition of life" and developed their theories to understand the nature and characteristics of living systems (Costa & Tribolet, 2015).

The goal of self-organizing systems is to "produce themselves" and, as a result, present the organization itself and its identity as a product (Morgan, 1998, p. 281). Self-organizing systems are adaptable and agile; they develop themselves. The most prominent features of self-organizing systems are as follows (Reigeluth, 2004):

- Openness: To be open to its environment, the system must actively seek information around it and make this information widely available within the system. However, the system must go beyond searching for and circulating information in its environment; it must also become a part of its environment. When it becomes part of its environment, the system gradually gains autonomy from its environment and develops new capacities that make it more skillful.

- Self-reference: The system changes in a way that remains consistent with itself by referring to the fundamental ideas, values, or beliefs that give it an identity. In this way, when the environment changes and the system realizes that it needs to change, change occurs in a way that is always consistent with itself. Change is never random; the system does not move towards strange new directions.

- Autonomy: People are free to make their decisions about changes. The more freedom there is in self-organization, the more order there is. When sufficient freedom is given by making self-reference, the system allows changes to occur before reaching a crisis point, creating more stability and order. Paradoxically, by self-organizing, the system will be "less controlling but more orderly."

To understand the changes and transformations that occur in the system, self-organization requires a focus on both internal and external factors. Additionally, "self-adapting systems are considered as systems that force themselves to production and living, co-evolving systems" (Erdemir and Koç, 2010). According to Coleman (1999), in turbulent environments, the system's adaptive capacity to the environment is increased through the logic of emerging new organizational forms (such as cellular forms), and the organization becomes stronger than each cell working alone with autonomous small teams (cells) seeking entrepreneurial opportunities and sharing knowledge among themselves.

> When environmental demands change, new cells can be formed and old ones disbanded as necessary; like an amoeba changing with its surroundings, the operating logic of the form is based on flexibility with accepted protocols of knowledge sharing substituting for hierarchical controls. Thus, cellular organizations are designed to be reconfigurable according to shifts in the market and/or the emergence of new knowledge (p.37).

When autopoiesis is examined from the perspective of organization management, it is observed that social structures exhibit open system characteristics in response to external influences. The organization transforms the information it receives from its environment and decides on the change it will implement in response to the impact within its internal structure. Of course, not every piece of information from the environment will cause a change within the organization, and sometimes the organization will choose the alternative of not reacting. The basis for the decisions the organization makes is whether the change is accepted within its internal structure. Since the information from the environment is evaluated by the organization in terms of its value and validity, any information can trigger one organization into action while being ineffective in another at any given time (Töremen, 2000).

Chaos Theory in the Management of Educational Organizations

Toffler (1980, cited in Reigeluth, 2004) defined three main waves of societal evolution. Significant changes in education systems accompanied each of these main waves. Thus, examples of co-evolution between education systems and their environments began to emerge. In the Agricultural Age, the dominant paradigm of education was a single-room school building, private lessons, and apprenticeship. In the

[4] Turbulence is the complexity of irregularities, with disorder, chaos, energy dissipation, and drift predominating its structure. It involves random movements (Altun, 2001).

Industrial Age, schools being modeled after factories, standardization, and teacher-centered learning became the dominant paradigm. Now, as the information age deepens, society is undergoing a dramatic change, like the days of the Industrial Revolution, putting significant pressure on education systems to evolve together. As the pace of societal changes increases, the need for co-evolution in education has become more urgent than ever (Reigeluth, 2004). In addition, sudden events like the global COVID-19 pandemic, which have affected all societies, have triggered changes in education at an unprecedented pace (Williamson et al., 2021) or increased expectations for change (Korkmaz & Toraman, 2020). Therefore, applying chaos theory to complex systems such as schools in the present day creates a significantly important opportunity for change and transformation because learning and thinking are not linear processes (Akmansoy and Kartal, 2014). Indeed, Toffler also accepts chaos theory as the new paradigm of the information age (cited in Mercan et al., 2013).

The three fundamental conditions listed as characteristics of a chaotic system, "non-linear operation," "iterativity (the output of one cycle being the input of the next)," and "small changes in initial conditions leading to significant differences in outcomes," are observed features in educational organizations (Erçetin et al., 2015, p.149). In an era where contemporary paradigms are unstable and constantly changing, education is intertwined with chaos and complexity, making itself largely unpredictable. This chaos affects education at every level and in all systems without exception, influencing all stakeholders as well (Erçetin and Bisaso, 2018). Therefore, defining education as a chaotic phenomenon, considering the multitude of factors influencing the success of these organizations (Ertürk, 2012), and managing the upcoming changes from this perspective will enhance success. In relation to the characteristics of chaos theory mentioned in previous pages, the following points can be made regarding change management in educational organizations:

- Chaos theory guides educational organizations to navigate through challenging processes. However, metaphors such as "fractals," "strange attractors," and the "butterfly effect" seem distant from organizational behavior for managers and practitioners. Managers must accept the reality that successful educational organizations are complex networks with non-linear feedback loops (Gunter, 1995).

- Educational organizations are open systems that are constantly in interaction with their environment. However, in the information age, where society undergoes rapid changes, and the future is uncertain and unpredictable, these organizations are obligated to shape the future of societies. Therefore, as Erçetin and colleagues (2015) pointed out, educational organizations need to be designed in ways that encourage proactiveness and support changes to be effective in education and teaching (for an example design, see Figure 3).

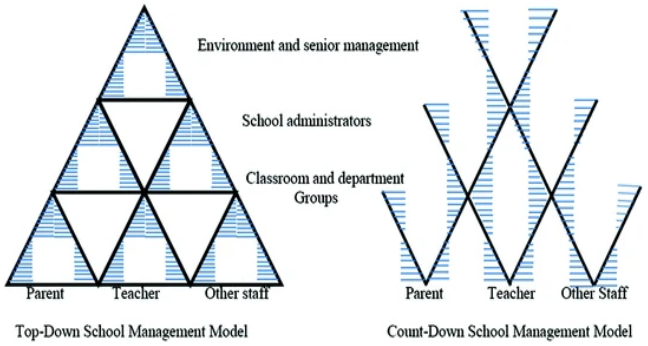

Figure 3.
Comparative View of Two Different School Management Models (Erçetin & Bisaso, 2015)

- Another important factor in effectively managing change in educational organizations is the leadership process. According to Erçetin et al. (2013), leading an organization in chaotic situations involves creating different leadership compositions for each situation and deciding which type of leadership to use. This, in turn, is only possible if the leader accurately analyzes the current situation. Therefore, leadership in chaotic environments is about discovering the nature of the system, its effects, and the periodicity of these effects. As Altun (2001) pointed out, studies on chaos theory show that managers who are familiar with chaos theory are more effective in solving chaotic situations Although Shufutinsky and colleagues (2021) define leaders who can adapt to highly chaotic and changing situations and take proactive steps as "shock leaders," it does not seem logical to find and recommend a single leadership style for all situations in chaotic systems. Instead, in a chaotic environment, the expected behaviors from leaders or leadership can be as follows (Erçetin et al., 2013, p. 100):

    - Especially having knowledge about the system,
    - Discovering the basic elements affecting the system,
    - Discovering the periodic relationship between these effective elements,

- Considering this relationship network when making managerial decisions,
- And most importantly, having an extremely strong leadership profile that goes beyond necessity, including skillfully using all relevant leadership styles and models.

- Complex systems, due to their sensitivity to internal conditions, can lead to turbulence or chaos even with small changes in their environment (Bayramoğlu, 2016). Educational organizations can also be influenced by attractive elements such as the characteristics of society, the quantity and quality of human resources needed by the economy, and technological developments (Çobanoğlu, 2008), and this influence can force the system to a new organizational structure (fractals). Therefore, instead of a mechanical response expected from the system, new structures that solve these unpredictable problems in the direction of organizational restructuring should be realized. In such cases, "members of the organization must adopt forms of continuous reorganization with teamwork and project teams, and the continuous renewal of teams can mean the full use of individuals' creativity and potential" (Çobanoğlu, 2008). Such social interactions are based more on collaboration than on implicit agreement: what matters is open communication, active listening, recognizing learning opportunities, and the individual's capacity for self-motivation and self-regulation (Gunter, 1995). In addition, when educational organizations approach the threshold of chaos, they should have personnel who can self-organize and take instant action at a high level; plans and projects should be prepared together with implementers rather than at the top of the organization, and the organization should have a dynamic structure with a shared vision, mission, and values, seeking continuous innovation and change in education and learning (Bayramoğlu, 2016).

- "Bifurcation points" have provided organizational management with a different perspective on events (Erdoğan, 2012). Experiments, innovations, and attractors such as taking individual initiatives (Thiétart & Forgues, 1995) are sources of instability for educational organizations and can push the system out of its programmed route and stable balance. Similarly, dialogues among teachers, students, and all other stakeholders about stories, problems, unresolved situations, and incomplete initiatives can create the conditions necessary for the system to organize itself. All of these contribute to breaking the existing status quo, arousing curiosity, revitalizing interaction, and change. This interaction and change always form the basis for the transformation of the system at different levels and in different places (Erçetin et al., 2015).

- When educational organizations reach the edge of chaos, choosing one of the options presented (bifurcation point) means making irreversible decisions. For example, due to the COVID-19 pandemic and the subsequent need for social distancing, online learning has gained unprecedented momentum for educational institutions to quickly adapt to the situation and continue education. However, there are also criticisms that this technology-driven change, often seen as neutral, is being imposed on education to address growing societal issues. The question of whether the decisions made by education leaders truly pave the way for the desired future of education is being debated (Teräs et al., 2020). Therefore, occasionally making reversals in the education system and re-adopting elements that have lost their functionality will both lead to losses and negatively affect the change initiative and the perceptions of the system members towards change.

- Chaos Theory allows educational managers to see that they have a third option in addition to stability or dissolution, and that is to work within "limited instability." Therefore, a successful educational organization will deviate from the balance between stability and dissolution, and management behavior will operate in a continuous order and chaotic environment. The future is unseen because it is unpredictable and subject to change. Feedback can generate complex behaviors where a direct connection between cause and effect is not readily apparent. The future is created by sensitive responses to fluctuations in the environment or by the "Butterfly Effect" - "the flapping of a butterfly's wings in one part of the world can cause a storm in another" (Gunter, 1995). Just like the COVID-19 pandemic creating a butterfly effect worldwide, deeply affecting many areas such as education, health, economy, or involving all stakeholders of the education system including students, teachers, administrators, and parents (Ceylan, 2022). Baker (1995, cited in Altun, 2001) also stated that schools exhibit a nonlinear situation, and the Butterfly Effect is observed in these systems, and even simple decisions made by management can have very large effects; events can create a ripple effect and spread beyond the school. Therefore, in managing change in educational organizations, considering all

variables together, considering that even small changes can create a "Butterfly Effect," is essential. Additionally, the "butterfly effect" underscores the understanding that one person can have an impact, so educational organizations should mobilize and motivate all their human resources to unleash their full potential.

Conclusion

The recent COVID-19 pandemic, essentially a health issue, has led to numerous crises because of the complexity of the real world and the interdependence between human life and social, scientific, economic, political, educational, cultural, and religious phenomena. It has increased awareness of the inevitability of chaos. Like all sectors, it has necessitated mandatory changes to ensure effectiveness in educational organizations. Considering that education and educational organizations are inherently chaotic structures directly affected by changes in all areas, effective management of change in these organizations has become even more critical. In such times, traditional detailed plans, controls, and routines are replaced by a holistic view of events, structures that can adapt to rapid changes and human resources. Chaos theory, which offers a different perspective on organizational change, provides ways to facilitate its management by exploring the nature and source of change. This theory suggests to educational organizations that survival in a rapidly changing environment depends on their adaptation to their environment or context; they can be driven to the brink of chaos by inevitable crises or situations (attractors) and seize new opportunities; and that in the face of encountered problems, a holistic perspective encompassing all factors and developing different solutions is more functional than traditional solutions.

Based on the advantages provided by complexity science and chaos theory, educational organization managers can be recommended the following: (i) Establish a flexible, dynamic, and adaptable structure within educational organizations and adopt a collaborative and innovation-friendly culture to tackle complex situations effectively. (ii) Create a working environment where the potential of human resources is well analyzed, teamwork is encouraged, and creativity is supported, (iii) Recognize that such a shift in understanding can only be achieved with a workforce equipped with the necessary skills and knowledge to lead in any situation. Therefore, it is essential to provide conditions that enable all educational managers to acquire the required leadership skills and knowledge.

Limitations

This study, aiming to examine organizational change and change management in educational organizations from the perspective of complexity science and chaos theory, is designed in the form of a traditional review. Therefore, one limitation of this study is that the literature on the subject has not been systematically reviewed, and only publications in Turkish and English have been included. In this context, the author acknowledges the possibility that selection bias may have influenced the studies included in this review due to the use of a traditional method instead of a systematic approach.

Etik Komite Onayı: Bu çalışma, araştırma yöntemi olarak geleneksel derlemeyi kullandığı için etik kurul onayına ihtiyaç duymamaktadır.
Hakem Değerlendirmesi: Dış bağımsız.
Yazar Katkıları: Bu çalışmanın tüm aşamaları yazar tarafından yürütülmüştür.
Çıkar Çatışması: Yazar, çıkar çatışması olmadığını beyan etmiştir.
Finansal Destek: Yazar, bu çalışma için finansal destek almadığını beyan etmiştir.
Ethics Committee Approval: This study, using a traditional literature review as its research method, does not require ethical approval.
Peer-review: Externally peer-reviewed.
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Genişletilmiş Özet

Giriş

Günümüzde insanoğlunun başardığı ya da beklemediği pek çok yeni durumla karşılaşıyoruz. Hargreaves'in (2002) dediği gibi "sonsuz ve acımasız değişim dünyasında yaşıyoruz… ve değişim, yeni bilgi, beceri ve deneyimleri kabul etmemiz ve bunlarda uzmanlaşmamız için bizi zorluyor"(s. 189). Değişim, "insanlığın bilinen en eski gerçekliklerinden biri" olarak kabul edilir (Şen & Batı, 2020, s. 76). Yunanlı filozof Herakleitos'un "değişmeyen tek şey, değişimdir" sözü o kadar çok benimsenmiş durumda ki günümüzde değişim artık sorgulanmıyor. Dahası, teknolojik gelişmeler, insanların gereksinimlerindeki artışlar ve çeşitlilik ile bireylerin farkındalık düzeylerinin artması gibi faktörler de değişimi hızlandırmış ve örgütler için değişimi bir zorunluluk haline getirmiş durumda.

Değişim, bazen örgütlerin varlığı için bir tehdit bazen de bir fırsat olarak ele alında da maalesef günümüz örgütleri, sürdürülebilir ve etkili bir değişimi gerçekleştirmede çoğu zaman başarısız olmaktadır (Lewis, 2019; Stouten vd., 2018; Vakola, 2014; Van Tonder, 2004). İlgili araştırmalar da yöneticilerin planlanan üç örgütsel değişim müdahalesinden sadece birinin gerçekten başarılı olduğuna inandığını (Meaney & Pung, 2008, akt., Armenakis & Harris, 2009) ve Birleşik Krallık'taki yöneticilerin de sadece %38'inin örgütlerindeki değişimin başarılı olduğunu düşündüklerini (Holbeche, 2006, akt., Stouten vd., 2018) ortaya koymaktadır. Eğitim örgütlerindeki değişimlere ilişkin benzer değerlendirmeler, ülkemizde yürütülen çalışmalarda da (Kondakçı, ve ark., 2019; Toprak, 2018) görülmektedir. Diğer taraftan kavramsal ve kuramsal anlamda yeterli birikim olmasına rağmen, eğitim örgütlerinde başarılı bir değişimin nasıl gerçekleştirileceği sorusu, bilim insanları ve uygulayıcılar için en büyük endişe kaynağıdır, çünkü çoğu müdahale ya hedeflerine ulaşamamıştır ya da hiç uygulanmamıştır (Acton, 2021; Cheng & Walker, 2008; Toprak, 2018; Kondakçı ve ark., 2019). Sonuçlar incelendiğinde; girişilen değişim çabalarını başarısız kılan en önemli faktörün değişimin ve değişimi gerektiren koşulların yeterince anlaşılmaması olduğu söylenebilir. Yaşanan değişimlerle baş etmede eğitim örgütlerine avantaj kazandıracak faktörler, süreklilik gösteren değişim olgusunun doğasını ve kaynağını bilmek (Çobanoğlu, 2008) ve değişimin başarı olasılığını artırmak ve başarısız değişimlerin örgüt üyeleri ve paydaşları üzerindeki olumsuz sonuçlarını azaltmak için örgütsel değişimi daha iyi tanımlamak olacaktır. Ancak, bunun yanında, durumları değerlendirmede referans aldığımız paradigmaların da gözden geçirilmesi önemli görülmektedir. Yaşanılan belirsizliklerin ve kriz durumlarının etkili şekilde yönetilememesi, kaynağın doğru bir şekilde belirlenememesinin yanı sıra yaşanılan pek çok durumun karmaşıklık paradigması yerine doğrusal (Newton) yaklaşımlarla ele alınmasına da bağlı olabilir.

Bu çalışmanın, değişen durumları değerlendirmede referans olarak kullanılan paradigmaların gözden geçirilmesine ve yaşanan değişimlerin daha iyi anlamlandırılmasına ışık tutacağı düşünülmektedir. Ayrıca, eğitim örgütlerinin karmaşıklık bilimi ve kaos teorisi yardımıyla süreklilik gösteren değişim olgusu karşısında farklı bir bakış açısı geliştirmesine ve etkili bir şekilde yönetilebilmelerine de katkı sağlayabileceği için önemli olduğu düşünülmektedir. Bu çalışmanın amacı hem uluslararası literatürden hem de önceki araştırmalardan (Örn; Akmansoy & Kartal, 2014**;** Altun, 2001; Çobanoğlu, 2008; Ertürk, 2012; Gürel, 2018) yola çıkarak, karmaşıklık bilimi ve kaos kuramının değişimi açıklamasına yönelik kavramsal bir yapı sunmaktır. Daha sonraki aşamada ise eğitim örgütlerindeki uygulamalara yönelik bir çerçevenin geliştirilmesi amaçlanmaktadır. Araştırmaya yön veren kapsamlı araştırma sorusu şu şekilde sunulabilir: Karmaşıklık bilimi ve kaos kuramı, eğitim örgütlerindeki değişimin doğasının ve kaynağının keşfedilerek yönetilmesini kolaylaştırabilecek anlayışlar sunabilir mi ve değişimi yönetmede rehber olarak hizmet edebilir mi? Bu makalede ele alınacak iki yardımcı araştırma sorusu şunları içermektedir: i) Literatürün incelemesine ve analizine dayalı olarak değişimi değerlendirmede referans alınan paradigmadaki değişim nedir? ii) Kaos kuramı nedir ve değişimi nasıl açıklamaktadır?

Yöntem

Bu derlemede sunulan bilgiler, eğitim örgütleri için değişimin doğasına ve yönetimine farklı bir bakış açısını sunan karmaşıklık bilimi ve kaos kuramı konusunda genel bir bakış sunmaktadır. Bu nedenle, belirli bir konuda daha önceden yapılmış çalışmaların bir araya getirildiği, yorumlandığı ve sonuç ve değerlendirmelerinin sentezlendiği "geleneksel derleme" olarak tasarlanmıştır (Torgerson ve ark.., 2017, s.357). "Örgütsel değişim", "Karmaşıklık bilimi ve kaos kuramı" konularıyla ilgili hakemli makalelere ve kitaplara yazarın görev yaptığı üniversitenin kütüphanesinin elektronik kaynakları aracılığıyla erişilmiştir. Anahtar kelimeler olarak "değişim", "örgütsel değişim", "eğitim örgütlerinde örgütsel değişim", "karmaşıklık bilimi", "kaos kuramı", "eğitim örgütlerinde kaos" ve "eğitim yönetiminde kaos" ifadelerini içeren çalışmalar aranmıştır. Çalışma kapsamına dahil etme kriterleri olarak "İngilizce veya Türkçe dillerinde yazılmış olma" , "tam metnine ya da özetine ulaşılabilme", "türü ve yayın yılı

fark etmeksizin akademik bir çalışma olma" kabul edilmiştir. Yazar çalışmanın uygunluğunu, makalenin başlığını, özetini ve ulaşılabiliyorsa tam metnini okuyarak belirlemiştir. Belirlenen anahtar kelimelerin ve ilgili kavramların kombinasyonlarını içeren aramalar, yazar doygunluk olduğuna inanıncaya kadar devam ettirilmiştir.

Sonuç

Temelde bir sağlık sorunu olan son dönemdeki COVİD-19 salgını, gerçek dünyanın karmaşıklığı ve insan yaşamı ile sosyal, fen, ekonomik, politik, eğitimsel, kültürel ve dini olgular arasındaki karşılıklı bağımlılığın bir sonucu olarak birçok krize yol açmış; kaçınılmaz olan kaosa ilişkin farkındalığı arttırmıştır. Tüm sektörlerde olduğu gibi eğitim örgütlerinde de etkililiğini sağlayabilmesi için zorunlu değişimleri gerektirmiştir. Eğitim ve eğitim örgütlerinin her alanda yaşanan değişimlerden doğrudan etkilenen kaotik bir yapıya sahip olduğu göz önünde alındığında da bu örgütlerdeki değişimin etkili yönetimi daha da kritik hale gelmiştir. Böyle zamanlarda alışılan detaylı planlar, denetimler ve rutinler, yerine olaylara bütüncül bir bakış, hızlı değişimlere ayak uydurabilecek yapılar ve insan kaynakları önem kazanmış durumdadır. Örgütsel değişime farklı bir gözle bakmayı sağlayan kaos kuramı, değişimin doğasını ve kaynağını keşfederek yönetimini kolaylaştırabilecek yollar sunmaktadır. Bu kuram, eğitim örgütlerine, hızla değişen bir çevrede var olabilmesinin, çevresi ya da bağlamıyla olan uyumuna bağlı olduğunu; kaçınılamaz farklı krizlerin ya da durumların (çekicilerin) etkisiyle kaosun eşiğine sürüklenerek yeni fırsatlar yakalayabileceğini; karşılaşılan sorunlar karşısında alışılmış çözümler yerine tüm faktörleri kapsayan bütüncül bir bakış açısı ve farklı çözümler geliştirmesinin daha işlevsel olduğunu ortaya koymaktadır.

Dolayısıyla, karmaşıklık biliminin ve kaos kuramının sağladığı bu avantajlara dayalı olarak eğitim örgütleri esnek, dinamik ve uyarlanabilir bir yapıya ve karşılaşabileceği karmaşık durumlara karşı işbirlikçi ve yeniliğe açık bir kültüre sahip olması gerekmektedir. Ayrıca, sahip oldukları insan kaynağının potansiyelini iyi analiz ederek takım çalışmasının ve yaratıcılığın desteklendiği bir çalışma ortamını da yaratılması da önemli görülmektedir. Böyle bir anlayış değişikliğinin de bunu gerçekleştirebilecek donanıma sahip insan kaynağı ile mümkün olacağından hareketle, Tüm eğitim yöneticilerinin her türlü durumda liderlik edebilecek bilgi ve liderlik becerilerine sahip olması gereklidir.

Sınırlılıklar

Örgütsel değişime ve eğitim örgütlerinde değişimin yönetimine karmaşıklık bilimi ve kaos kuramı perspektifinden bakmayı amaçlayan bu çalışma, geleneksel derleme biçiminde tasarlanmıştır. Dolayısıyla konuyla ilgili literatürün sistematik bir biçimde ele alınmamış olması ve sadece Türkçe ve İngilizce dillerindeki yayınların kapsama alınması bu çalışmanın sınırlılıklarıdır. Bu bağlamda, yazar, sistematik yöntem yerine bu derlemede geleneksel yöntemin kullanılması nedeniyle, seçim yanlılığının kapsama alınan çalışmaları etkilemiş olabileceği olasılığını kabul etmektedir.