



ISSN: 0975-833X

Available online at <http://www.journalera.com>

International Journal of Current Research  
Vol. 13, Issue, 02, pp.16299-16301, February, 2021

DOI: <https://doi.org/10.24941/ijcr.40814.02.2021>

INTERNATIONAL JOURNAL  
OF CURRENT RESEARCH

## RESEARCH ARTICLE

### CHAOS THEORY: APPLIED TO THE DISRUPTION OF EDUCATION DURING COVID-19 PANDEMIC

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#### ARTICLE INFO

##### Article History:

Received 14<sup>th</sup> November, 2020  
Received in revised form  
10<sup>th</sup> December, 2020  
Accepted 07<sup>th</sup> January, 2021  
Published online 28<sup>th</sup> February, 2021

##### Key Words:

Butterfly Effect, Chaos Theory,  
COVID-19 Pandemic.

#### ABSTRACT

The Chaos Theory was used to analyze the disruption to education due to the COVID-19 pandemic, which greatly affected learning continuity. Amidst the disorder, the Chaos Theory application was instrumental in finding direction and understanding how all variables are interrelated to the whole educational system. The key to seeing the order within the disorder is by critically analyzing how the school leaders manage, lead, and respond immediately to the crisis. The education sector utilized learning technologies, resources, and collaborative efforts to create order by continuously configuring, reshaping, and transforming education curriculum and instruction, educational management, and educational leadership.

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Citation: Gerby C. Parra and Emily B. Tan. 2021. "Chaos theory: applied to the disruption of education during covid-19 pandemic", *International Journal of Current Research*, 13, (02), 16299-16301.

## INTRODUCTION

According to meteorologist Edward Lorenz, Chaos Theory is similar to "The Butterfly Effect." He quantified that a single flap of a butterfly's wings in the Amazon can eventually change a tornado's path in Texas.

This scenario indicates that a small amount of change can trigger a broad, massive, and diverse impact over time, exposing the randomness and unpredictability of a situation (Borwein & Rose, 2020). However, Borwein & Rose (2020) added that Chaos Theory is not about chaos per se; instead, it is about systems that self-organize from chaos. Chaotic systems are difficult to foresee, regulate, and manipulate. But when systems attain certain stability, order arises.

## METHODS AND MATERIALS

This paper utilizes the concept paper as a tool for pre-research proposal to introduce brief document to rationalize feasible future research undertakings (Mamansag, 2017). Published articles on the response of school systems to chaos during a national/global pandemics were read and synthesized.

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## RESULTS AND DISCUSSION

**Application of Chaos Theory on Education During the COVID-19 Pandemic:** Using the Chaos Theory and applying it to education during the COVID-19 pandemic, who would have ever guessed that a virus so small can cause global health crisis, socio-economic devastation, and education disruption globally? (Whitlock, 2020). The Chaos Theory's butterfly's single flutter of wings is akin to the minor illness brought about by the virus that first affected a 55-year-old Chinese individual in Wuhan, Hubei Province of China. This then escalated into a pandemic, rippling out in growing disturbance to education, forcing school leaders to quickly shut down schools last March for health and safety reasons, and then changing how the learning was delivered, taught, and assessed (3)(Harris & Jones, 2020). The chaotic scenario brought about by the impact of the COVID-19 pandemic on education affected school leaders, teachers, and students regardless of their nationalities, education levels, income, and gender. It pushed school leaders and teachers worldwide to their limit, scrambling for alternative learning modalities to mitigate the possible learning loss (Netolicky, 2020). This forced them to adapt to learning pedagogies and teaching delivery modes to which they were unaccustomed, unskilled, and untrained. Education was recrafted and redesigned as home-based learning, technology-driven, and co-taught by parents (OECD, 2020; Gouëdard *et al.*, 2020).

The emergence of order amidst the chaos was that across the world simultaneously, all countries' education systems implemented organized measures at different pace and context depending on the available resources and circumstances to create a sense of order to address the presence of COVID-19's effect on schooling and students' learning (Li & Lalani, 2020).

accommodate responses and concerns. The fear of contracting the Covid-19 virus resulted in online learning as the preferred learning modality in most schools. Given this preference, teachers researched for appropriate educational technology and applications to aid online teaching.

**Table 1. The Applications of Chaos Theory and Its Positive Effects**

Category	Chaos Systems Theory Application
Education	<p>Chaos Systems Theory helps education by seeking stability and making sense of a chaotic situation through constant change.</p> <p>The concepts of complexity, randomness, and unpredictability of Chaos Systems Theory are applicable in seeing the big picture in education instead of just looking at ideas in simplicity, regularity, and predictability.</p> <p>It helps understand patterns of behavior in the education system and within the subsystems. (10) (Trygestad, 1997).</p> <p>Student learning is transformative that requires a transformative curriculum based on chaos theory. A transformative curriculum is one which "will accept the student's ability to organize, construct, structure, and will emphasize this ability as a focal point in the curriculum as a process of development rather than a body of knowledge to be covered or learned" (11) (Doll, 1987).</p>
Educational Management	<p>Through observation and experimentation, which seemed as random and unpredictable, will be understood and managed as representative of patterned behavior (10) (Trygestad, 1997).</p> <p>This theory can assist in looking for behaviors to handle appropriately, manage, operate, and control available resources such as workforce, curriculum, instruction, assessments, and facilities during chaotic situations.</p> <p>According to different studies by (12) (13) (14) Cronback (1988), Cziko (1989), and Salmon et al. (1991), chaos theory can be applied to the classroom by enhancing learning through systemic approach reinforcement of human interaction, encouragement of cultural diversity; affirming that intelligence as dynamically multi-dimensional, learning processes as continuous, dynamic and nonlinear needing change, conflict, and diversity. The elements of Chaos Theory systems, fractals, initial effects, and bifurcations can be applied to classroom management.</p> <p>(12) Cronback (1988) affirms that teachers and educators seek understanding to respond to chaos and discover order by reducing instability and increasing predictive behaviors through categorizing and standardizing processes.</p> <p>Chaos theory has proven useful in understanding the characteristics of organizations' function, such as school administrators' roles and responsibilities to work successfully within school systems' complexities and intricacies. The complexities of everyday school operations require decisions and behaviors in educational management to respond to unexpected situations.</p>
Educational Leadership	<p>Successful educational leaders understand that relationships in the school system are vital for all subsystems to collaborate and help each other despite the contact change and complexities of the educational system and the environment (15) (Mason &amp; Kirkwood, 2020).</p> <p>The Chaos Theory helps educational leaders and other stakeholders provide a responsive leadership style to turbulent situations through a swift, proactive, and insightful, careful consideration of options to address specific issues or concerns (16) (Vardalier, 2017).</p>

This was done primarily by employing education stakeholders' responsive leadership style to provide a swift, proactive, and insightful, careful consideration of options resting on equity and resource availability (Harris & Jones, 2020; Netolicky, 2020). Almost overnight, school facilities, teachers' skills, curriculum pedagogies, modes of delivery, and assessment were upgraded or changed to cater to the current needs to find stability and order. All schools went through a change process to respond to the urgency of the situation and created order to manage the transition to a different teaching mode and delivery of quality student learning (Netolicky, 2020; Li & Lalani, 2020).

**First Stage of Emerging Order: Teachers' Online Trianing:** Amidst the COVID-19 pandemic and Enhanced Community Quarantine (ECQ) lockdown, schools started planning to understand the realities and implications of the current situation's disruption on teaching and learning. Educators collaborated online through social media and used technology to exchange ideas and update each other on the possible course of action (Netolicky, 2020). Some employed SWOT analysis to weave through the webs of sorting out the disadvantages and advantages of different learning modalities and scenarios. Most schools then organized their teams and resources, creating surveys to know parents' and students' pulse. The survey results were posted in Facebook and Messenger group chats, and plans were adjusted to

Upskilling and intensive online training for the usage of e-learning applications followed suit (Harris & Jones, 2020; Netolicky, 2020). Teachers underwent challenging online teaching training with endless motivation and constant virtual communication. Teachers' internet and training allowances, which some schools provided made the administrative leadership part manageable. Cultivating a responsive leadership style with open communication and immediate feedback was a part of the online teachers' training success(4) (Netolicky, 2020). Online authentic outputs provided collaborative engagements with peers and opportunities to monitor and supervise their learning progress. The teams helped each other in gaining digital application mastery.

**Second Stage of Emerging Order = Curriculum and Instruction:** When the ECQ was lifted, school educators and staff went back to school to plan and collaborate on online teaching processes to effectively deliver the curriculum and instruction. The primary concern was choosing an online curriculum format that maintains students' engagement and usage of 21st-century skills in instruction delivery (Li & Lalani, 2020). Moreover, some schools organized teachers per department to allow them some degree of autonomy to brainstorm bright ideas on implementing the online curriculum and delivery of instruction to share in the team's meeting. Then, all the suggestions from the different departments were gathered and analyzed together. Teachers started crafting

online curriculum lessons. School leaders bought the needed devices and subscribed to various educational applications while existing facilities were upgraded, and spaces were arranged to offer a comfortable online teaching experience (UNESCO, 2020; Li & Lalani, 2020). The flow of communication and feedback happened throughout the whole process of developing the online curriculum and instruction. Appreciation for innovative efforts and dedication was rendered to teachers through inspirational words and material or financial recognition. These small tokens of appreciation cemented the team's motivation. To monitor and supervise the online curriculum's quality, some schools included free trials for students and parents to get feedback and evaluate the online teaching curriculum delivery. Furthermore, student online application practice was conducted to enhance teachers' online teaching abilities and students' application familiarity. These measures enormously helped schools improve and develop online teaching processes and systems, giving everyone a sense of pride and ensuring the quality of online teaching and students' learning (Hargreaves & O'Connor, 2018; Netolicky, 2020).

## Conclusion

Looking through the lens of Chaos Theory in analyzing the effects of the COVID-19 pandemic to the education system, the pandemic produced severe and significant consequences on the loss of learning, skill growth of students, and their well-being. No one can estimate precisely how much COVID-19 interruption will affect learning, but one thing is for sure, the chaos that the COVID-19 pandemic brought has radically changed education forever. Indeed, the happenings in the world are unpredictable, complicated, and mired in complexities. Below is a table to show the positive effects of chaos in education, educational management and educational leadership. Hence, researchers and school policy-makers can explore some of the effects through empirical research investigations, whether qualitatively, quantitatively or both.

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