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A Qualitative Research on the Effect of Chaos and Butterfly Effect on Education

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Abstract

Chaos is a scientific approach that refers to the fact that systems or behaviors that are thought to be irregular, complex, impossible to predict actually occur in an orderly manner. The aim of this research is to determine what chaos and butterfly effect mean in terms of education, the importance of chaos and butterfly effect in education and its effects on education. The research is a qualitative study aimed at determining the opinions of teachers about chaos and butterfly effect. The case study method was used in the research. The research was carried out with 23 teachers selected on a voluntary basis among 44 teachers who are doing master's degrees in educational sciences. Research data were collected with a semi-structured interview form developed by the researcher. All the data obtained were analyzed by coding using the content analysis method. In the research, it was concluded that the chaos and butterfly effect positively affect students' development of different ideas, improve their ability to analyze, activate metacognitive functions, and give students the ability to solve problems more quickly by evaluating them from different point of view.

Keywords: Chaos, Inconsistency, Unpredictability, Uncertainty, Butterfly Effect

1. Introduction

From the first-time educational activities were implemented in schools until the 2000s, traditional, behaviorist or teacher-centered methods were used in teaching, and after the 2000s, constructivist or student-centered methods began to be used. Although the methods used have positive, problematic or limited aspects, it can be said that all systems used in education until today have been applied in a uniform order. Especially after the 2000s, with the effect of modernization and technological changes in many fields, it became inevitable to bring a new postmodern movement to the field of education, which is monotonous. In other words, in this century, it is necessary to move from modern education to postmodern education (Akcin & Zengin, 2020; Altun, 2001) and this new understanding of education, which should be applied in schools by arranging the education of all countries with a postmodern understanding of education, is the concept of chaos and the butterfly effect, which includes order in complexity and disorder (Warren, 2021).

Although it has just begun to be noticed today, the history of chaos, which is a philosophical concept, dates back to the first age civilizations (Yazgan, 2020). However, early studies on chaos theory started in Europe and the first findings about the theory were brought to the literature by researchers working mainly in Europe (Bicici, 2016). The concept of chaos derives from the verb khasko and was used in the meanings such as fracturing by yawning, yawning, opening, openness, splitting to give birth to something (Durusken, 2004: 6), today the concept of chaos has meanings such as disorder, confusion, irregularity and uncertainty (Ruelle, 2014: 93). In other words, chaos refers to disorder, which is the opposite of the concept of cosmos, which means order, arranging, correcting or tidiness (Akcin & Zengin, 2020; Egi, 2014).

Chaos theory is an unpredictable, irregular order of disorder in which similar situations occur, that is, a disorder with a purpose (Toremen, 2000: 204). Chaos is variable, non-linear, complex situations, inconsistencies, unpredictable events, processes or situations encountered in society (Bolay, 2018; Demir & Yakut, 2018; Turan, 2008). Although the theory of chaos seems to mean chaos and disorder at first glance, it does not express this exactly and chaos refers to the scientific investigation of order within disorder (Yakut, 2018; Yick, 2009; Gursakal, 2001-2007; Levy, 1994).

The inventor of the concept or theory of chaos is Edward Lorenz, a meteorologist and professor. Lorenz discovered a pattern that constantly repeats at the output when graphing the weather on a computer, but never the same repeats are exact. In 1961, while examining a long string, instead of examining the record from beginning to end, for shorthand, a middle value was entered into the computer as the initial value. In summary, he started calculating with the number 0.506921 and changed this initial value to 0.506. When he examined the change in this mathematically very small numerical sequence, he encountered a surprising result and this was the beginning of a new scientific view (Karacelik, 2021; Ucar, 2010; Gleick, 1987; Verma, 2005). Lorenz realized that when the data in the program developed to calculate the changes in the weather conditions are changed in this way, the possible result undergoes a great change (Ucar, 2010). Based on these results, Lorenz also realized that there is no room for predictions in non-periodic physical systems. Because, according to him, the equations consist of generalizations that only roughly describe the atmosphere (Gleick, 2016). Based on these studies, Lorenz introduced the concept, theory or method that he called the 'butterfly effect'.

The concept of the butterfly effect, which was put forward by Lorenz and used to express chaos, is explained as a very small change in the state of the system at the zero point, causing a change that follows it and grows exponentially over time (Ruelle, 2014: 59). In other words, it is the ability of someone who knows the initial states or conditions to calculate approximately how the system will behave (Gleick, 1995: 7). Based on Lorenz's statements or predictions, the butterfly effect or sensitive dependence on initial state theory (Guastello & Liebovitch, 2009; Benbya at al., 2020) has led to predictions on many subjects (Ufuktepe, 2004) such as *a butterfly flapping its wings in the Amazon may cause a hurricane in Texas* (Lorenz, 1995; Weitkamp, 2021; Cramer, 1998), *a butterfly flapping its wings in Beijing, China may cause a hurricane in New York, USA* (Arslan, 2020; Gursakal, 2001; Gleick, 1995), *a nail saves a horse, a horse saves a horse, a horse saves a soldier, a soldier saves a war, a war saves a homeland*. Thus, the butterfly effect actually revealed how important initial conditions or tiny irregularities are in chaos (Aricioglu & Karabiyik, 2019; Sardar & Abrams, 2011; Baysal, 2014: 23; Karatay, 2004).

Based on all these discourses, chaos is a scientific approach which states that systems and behaviors that are thought to be irregular and impossible to predict, indeed disorder itself, occur in an orderly manner. In the chaos and butterfly effect, there are reasons that cannot be determined exactly, rather than a simplified cause-effect relationship (Ural, 2004: 4). Events that do not draw our attention in daily life, seem to be coincidences, but are actually part of a systematic order, are actually evidence of chaos (Aybala, 2018: 6).

The reason why education is desired to be provided with the chaos method is that education has a dynamic system and learning and thinking consist of non-linear processes (Seger, 2002; Akmansoy, 2012; Pamuk, 2013). Because the success of education systems depends on the fact that schools must have complex nonlinear feedback networks (Gunter, 1995).

There is a constant turmoil, confusion, disorder or chaos in education and training activities. Since schools and classrooms are constantly intertwined with problems, they have a chaotic structure between consistency and inconsistency. In order for a school to be successful, especially the structure of the school must be complex and full of chaos. Because school systems are open systems and they have structures that can cause disorder and chaos at any moment. Successful education systems are far from the balance between consistency and inconsistency (Toremen, 2000). A simple incident that may occur in schools can have a huge impact in the future. The fact that a teacher gives a small punishment to an unsuccessful student can cause huge changes in the student's behavior or academic achievement. Schools may become more sensitive, fragile and chaotic over time due to sudden, unexpected, and large-scale events experienced in changing environments with the uncertainty coming to the fore (Karakose, Imamoglu & Ince, 2020). Therefore, schools should be shaped according to chaotic situations. According to Ruellle, (1995), it is necessary to implement models based on impositions, which are non-linear and intertwined with chaos in schools, and which will put into practise learning and research (Pallotti, 2018; Larsen-Freemen, 2018). For this reason, teachers in schools should be trained in terms of chaos and its effects. The teacher, who is the manager of the classroom, should be able to see the classroom as a chaotic environment and manage the chaos effectively (Demirtas, 2006). In chaotic environments, administration should focus on change and be open to changes (Yakut, 2018). School administrators should also be cautious against the chaos that may occur in the school, have a flexible management approach, cooperate, and be able to look at all kinds of events and problems that are experienced or to be experienced from different perspectives, job satisfaction of its employees and analyze the encountered problems according to multiple variables (Balyer, 2017; Erturk, 2012; Hacicaferoglu & Hacicaferoglu 2013; Northouse, 2016).

2.1. Purpose of the Research

The aim of this research is to determine what chaos and butterfly effect mean in terms of education. In addition, the importance of chaos and butterfly effect in education and its effects on education are also among the aims of the research.

2.1.1. Problem Statement of the Research

What are the teachers' views and thoughts on the chaos and butterfly effect in education?

Sub-problems of the research

1. What does chaos mean in terms of education?
2. What is the importance of chaos in education?
3. What is the importance of the butterfly effect in education?
4. What should be done when a chaotic event is encountered at school or in the classroom?
5. How can chaos and butterfly effect affect educational activities?

2. Method

2.1. Research Pattern

This research is a qualitative study to determine the opinions of teachers about chaos and butterfly effect in education. In the research, the data of the situations determined by the researcher were collected by interview method, and the case study method, in which "the situation is examined in detail and the themes related to the situation are described", was used in the research (Buyukozturk et al., 2014: 21). In addition, during the conversations and interviews with the teachers in this research, the opinions of the teachers about the chaos and butterfly effect were recorded and analyzed, and a case study design was also used in the research in order to describe the subject in depth, based on both the interviews and the analyzes made.

2.2. Study Group

The research was started with a total of 44 teachers working in various schools in Hatay, Turkey and doing postgraduate studies in the field of educational sciences at Hatay Mustafa Kemal University. Then, in order to reflect the diversity of individuals who may be a party to the problem at the maximum level, the research was carried out with 23 teachers selected on a voluntary basis among 44 teachers as a result of the interviews with the teachers through maximum diversity sampling, one of the purposeful sampling methods. While forming the study group, a volunteer agreement was signed with the teachers participating in the research in terms of research ethics, and the names of the teachers were kept confidential and coded as T1, T2, T3, …, T23.

2.3. Data Colection Tool

In the research, a semi-structured interview form was prepared by the researcher and the research data were collected in order to get the opinions of the teachers about the chaos and butterfly effect. While preparing the interview form, first of all, previous research on the subject and the literature on the subject were examined. In addition, expert opinions were used for the semi-structured interview form to be used as a data collection tool in the research. First, a draft form was created, then the opinions of 4 doctoral faculty members working on chaos in education were received regarding the questions in the form, and the interview form and the questions in the form were corrected according to the feedback from the experts. Then, in order to eliminate the ambiguity regarding the questions, the questions in the form were revised with the help of 3 doctoral faculty members working in Turkish teaching, and the questions in the form took their final form. In order to collect the data in the research, each teacher was interviewed for an average of 20 minutes. During these interviews, some teachers wanted to fill in the form developed for the research, and some teachers wanted a voice recording. In line with the wishes of the teachers, the wishes of each teacher were fulfilled. In this way, the collection of research data took approximately 2 weeks.

2.4. Analysis of Data

While analyzing the data in the research, the questions in the interview form were used to determine the main themes. In the data analysis process, firstly the forms filled by the teachers and the recorded interviews were transcribed from the audio recording and all the data were transferred to the computer. All data obtained from the interviews were subjected to content analysis. In order to obtain accurate and reliable findings in the code generation process, the codes determined by the researchers were used in the analyzes in line with the consensus, by performing coding with 3 Doctor lecturers who worked in the field of curriculum development in education and had coded many times before. The generated codes were tabulated, and maximum attention paid to ensure that the codes were understandable.

3. Findings

In this part of the research, the findings, analyzes and analysis of the research is included.

Table 1: What is chaos according to teachers?

CATEGORY	CODE	PARTICIPANT	FREQ.
	Uncertainty	T1,T2,T3,T4,T5,T6,T7,T8,T9,T10,T12,T15,T17,T18,T19,T20,T22,T23	18
	Confusion, complexity, chaos, turmoil	T2,T3,T4,T5,T6,T7,T8,T9,T11,T12,T16,T17,T18,T19,T20,T22,T23	17
Inability to Predict	Irregularity, disorder	T3,T4,T6,T8,T10,T13,T14,T16,T17,T19,T21,T22,T23	14

	Imbalance,	T1,T2,T4,T6,T7,T9,T11,T15,T19,T21,T23	11
	Disharmony, discord	T2,T3,T4,T8,T11,T15,T16,T18,T20,T23	10
	Instability, inconsistency	*T1,T3,T4,T5,T7,T9,T10,T15,T18,T21*	10
	Unpredictability	T1,T2,T3,T4,T5,T6,T8,T10,T11	9
	Uncontrollable	T3,T8,T10,T12,T18,T19,T21,T23	8
Inability to Control	Nonlinear	T4,T7,T10,T15,T19,T20	6
	Turbulence, mobility	T5,T7,T15,T19,T22	5
	Negligence	T1,T9,T17,T21	4
	Emptiness	T2,T8,T19	3

When table 1 is examined, it is seen that the opinions of the teachers on the chaos and butterfly effect are first grouped under two categories as *'inability to predict'* and *'inability to control'*, and then the views of teachers belonging to these categories are named with 12 different codes. *Inability to predict* category is named by coding as uncertainty 18, confusion, complexity, chaos, turmoil 17, irregularity, disorder 14, imbalance 11, disharmony, discord 10, instability, inconsistency 10, unpredictability 9, and *inability to control* category is named by coding as uncontrollable 8, nonlinear 6, turbulence, mobility 5, negligence 4 and emptiness 3.

Some of the teacher's views on chaos are as follows. T1 of the participants said, *"Chaos is fear first for me. Then it is a complex and incomprehensible structure, inconsistency, unpredictability, ambiguity, neglect and obscurity". T3 said "Chaos is darkness, complexity, bewilderment, inability to understand, confusion, uncertainty, irregularity, non-compliance, inconsistency, turmoil with uncontrollable event or events". According to T4, "Chaos is a state of non-linearity, turmoil, confusion, unpredictability, imbalance, incoherence, instability, uncertainty. It is the being unaware of the process and consequences of an event to be experienced". T8 stated the idea that "something happens at any moment, an event is experienced and these things are uncertain, disharmony, unpredictability, uncontrollability, confusion and irregularity". According to T12, "Chaos is turmoil, uncertainty, confusion and events that cannot be controlled". T15 said "Chaos is not knowing what will happen or where events will lead, turbulence, inconsistency, imbalance, non-linearity, disharmony". According to T18 "Chaos is obscurity, instability, disharmony, darkness, turmoil, uncontrollable situation, confusion and uncertainty". T19 stated the idea as "Chaos is uncontrollable, mobility, turbulence, uncertainty, non-linearity and imbalance". T22 said, "Chaos is the state of being unable to make predictions about a subject, not being able to understand the subject, being uncertain, tension, stress, uncertainty and confusion". According to T23, "Chaos means disharmony, an event that cannot be controlled, uncertainty, imbalance, irregularity, confusion".*

Table 2: The effects of chaos in education according to teachers

CATEGORY	CODE	PARTICIPANT	FREQ.
Success	Enriches/improves education by analyzing it.	T1,T3,T4,T6,T7,T9,T11,T12,T13,T14,T15,T16,T17,T18,T19,T21,T23	17
	Provides opportunities for those who fail in education.	T1,T3,T5,T6,T7,T9,T11,T14,T16,T17,T18,T20,T22,T23	14
	Increases the success of the school and the student.	T2,T4,T6,T8,T10,T11,T13,T15,T18,T19,T20,T23	12

	Provides feedback on staff and students.	T1,T5,T7,T8,T9,T12,T15,T18,T20,T21	10
Unexpected Effect	Leads from small changes to big changes.	T3,T7,T8,T9,T15,T17,T18,T20,T21	9
	Helps to deal with indecision.	T4,T7,T9,T12,T18,T20,T22	7

When table 2 is examined, it is seen that teachers' views on the effect of chaos in education are first gathered under two categories as *success and unexpected effect*, and then these categories are expressed with 6 different codes. *Success* categort was coded as enriches/improves education by analyzing 17, provides opportunities for those who fail in education 14, increases the success of the school and students 12, provides feedback on staff and students 10 and *unexpected effect* category was coded as leads from small changes to big changes 9, helps to deal with indecisions 7.

Some of the teachers' views on the impact of chaos in education are as follows. *According to T1 "First of all, chaos is uncertainty and confusion. However, sometimes being able to resolve small messes can prevent larger ones from emerging. Chaos also improves student skills by enabling students to develop ideas in teaching. Students who solve chaos situations can look at problems from different points of view and solve their problems more quickly. The academic success of the student who copes with a chaotic situation also increases". T4 said, "Chaos in education means a problematic situation. Therefore, problems in education should be analyzed and solved with students in a logical way. In this way, determined, combative and successful students who can cope with problems through chaos and struggle with chaos can be raised". T5 stated the idea that "Chaos means coping with problems and gives feedback to teachers about analyzing and solving problems of unsuccessful students in education. It also guides teachers on how teachers should conduct lessons". According to T8, "Chaos situations in education will improve students' problem-solving skills and thus help students gain behavior of coping with problems. Students who can cope with problems can get out of stressful and anxious situations more easily. Since these students are competitive in the face of the problems they encounter, these students are more successful in their lessons". T11 stated "Students who can struggle with chaos in education can analyze events more easily. Thus, even unsuccessful students can achieve success thanks to the attitudes they have gained. This success can sometimes be the success of the student, sometimes the success of the class and sometimes the whole school". T18 said, "Through chaos, students can learn to fight problems in education. These struggles can add diversity and richness to the student and the class in terms of teaching. It can increase the success of students, increase their fighting spirit, raise their awareness, and enable them to gain experience. It can give ideas to teachers about students". According to T20, "As chaos or chaotic environments are full of complexities, they can provide opportunities for unexpected situations to occur in the classroom. It can offer equal or near-equal opportunities to all students. By making unexpected changes in unexpected students, it can allow these students to exhibit unexpected performances. It can make students self-confident. It can increase self-confidence. However, for all these, students need to know how to fight against chaos and the teacher in the education and training environment should be knowledgeable enough about chaos and fighting against chaos."*

Table 3: The effects of the butterfly effect on education according to teachers

CATEGORY	CODE	PARTICIPANT	FREQ.
	Small changes lead to big differences	T1,T3,T4,T5,T6,T8,T9,T10,T11,T12,T13,T15,T17,T18,T19,T20,T21,T23	18
Big Effect	Small irregularities create regularity	T1,T2,T3,T4,T8,T10,T11,T13,T15,T17,T19,T20,T22,T23	14
	Small problems can lead to big decisions	T5,T6,T9,T12,T14,T19,T20,T23	8

	Small disorders can bring more flexible management	T2,T5,T9,T15,T19,T21	6
	Precise commitment to the starting point	T2,T7,T8,T9,T11,T13,T14,T 18,T19,T22,T23	11
Internal Effect	Depend on internal dynamics, not external factors	T1,T3,T4,T5,T8,T9,T13,T14, T15,T20	10

When table 3 is examined, it is seen that the opinions of the teachers on the butterfly effect in education were first grouped under two categories as 'big effect' and 'internal effect', and then these categories were expressed with 6 different codes. In the research, big effect category was coded with codes as small changes lead to big differences 18, small irregularities create regularity 14, small problems can lead to big decisions 8, small disorder can bring more flexible management 6 and internal effect category was coded with codes as precise commitment to the starting point 11, depend on internal dynamics, not external factors 10.

Some of the teachers' views on the butterfly effect in education are as follows. *T3 stated that "Some of the behaviors experienced in education can lead to great changes in the individual by personally changing the individual, arranging or improving the individual. It can even change the individual in a positive way and in every sense unpredictably. When this change is examined on a school or class basis, such effects can increase the success of the school or class". According to T8, "Behaviors that are too small to be insignificant can sometimes lead to huge, unexpected results. It depends on the first effect it will have on the individual or the individual being affected by the event. Some situations or changes that seem to be negative can change the individual in a positive way very dramatically". T9 said, "It is when a person is affected by a small event and brings about big changes in himself. Or, it is the fact that the individual achieves a great deal of success by expressing the power within him under the influence of a small factor. Here it is the initial effect that moves the individual. Based on this effect, the individual actually caught the big change by making his own decisions". According to T13, "It is the situations that a child encounters that activate his behavior, but which, according to some, are illogical and sometimes very minor. These small situations can enable the individual to change their behavior in a positive way or to be more mature. As a result, such situations depend on the event or phenomenon that affects the individual. But the individual also needs to be ready and open to this change at any time". T15 stated that "If there is a desire for change, development or improvement in the individual, even very small movements can activate the individual and cause explosions in the individual. In this way, the individual can achieve success. In schools, such individual changes can lead teachers and administrators to a more flexible understanding". According to T20, "The butterfly effect is when a small spark grows into a fire. Sometimes a simple event can create a huge impact, and sometimes it can prevent bigger problems that may occur. In education, it is the ability of a child to change himself or to achieve success by being affected by a small event. When the butterfly effect is considered in terms of education and holistically, creating chaos for students and revealing the dynamics within the students with the effect of these chaos will increase the success of the school. Therefore, sometimes just a small touch is enough for a student to achieve success in education".*

Table 4: According to the teachers, opinions on what to do/how to proceed when faced with a chaotic event at school and in the classroom

CATEGORY	CODE	PARTICIPANT	FREQ.
	Appreciating differing opinions	T1,T2,T3,T4,T5,T7,T8,T 9,T10,T11,T12,T13,T15, T17,T18,T19,T20,T21,T 22,T23	20

External Focus	Communicating with different people outside of school	T3,T4,T5,T7,T10,T11,T 12,T13,T15,T17,T18,T2 0,T21,T22,T23	15
	Collaborate with administrators, teachers, and students	T1,T2,T5,T7,T10,T11,T 12,T13,T15,T17,T18,T2 0,T21,T22	14
	Assigning everyone involved	T1,T3,T5,T7,T11,T12,T 13,T17,T20,T22	10
	Getting help from those with experience	T1,T2,T8,T9,T11,T14,T 17,T20	8
Internal Focus	Making independent decisions	T1,T3,T4,T5,T7,T9,T10, T11,T12,T13,T15,T17,T 18,T19,T20,T21,T22,T2 3	18
	Analyzing the event	T1,T3,T6,T7,T10,T12,T 13,T17,T18,T20,T22	11
	Being flexible in the face of the event	T3,T7,T11,T12,T18,T21	6

When table 4 is examined, it is seen that teachers' views on what to do/how to proceed when faced with a chaotic event at school or in the classroom are first grouped under two categories as *external focus* and *internal focus*, and then these categories are expressed in 8 different codes. The category of *external focus* was coded with I value different opinions 20, I communicate with different people outside the school 15, I cooperate with administrators, teachers and students 14, I assign tasks to anyone involved in the event 10, I get help from those with experience 8 codes, *internal focus* category was coded with I make independent decisions 18, I provide maximum diversity by analyzing the event 11, I increase sensitivity by acting flexibly in the face of the event 6 codes.

Some of the views of teachers on what to do/how to proceed when they encounter a chaotic event at school or in the classroom are as follows. *According to T1, "I collect information about the incident I encountered, analyze the information and evaluate if there are different opinions on the subject. I make my decisions logically and flexibly but objectively, without being influenced, by benefiting from the opinions of those who have experience. But whatever the outcome, I try to resolve the case.". T3 stated, "When faced with a chaotic situation, the first thing I do is to stay calm and act calmly. Then I try to think rationally or act rationally. I try to handle the environment or situation. Before making my decisions regarding the incident, I request help from experienced people. I talk to the school administration, other teachers and students who know the situation. I do not take a strict attitude towards the event. I try to evaluate the event by analyzing it". T7 said, "First of all, I keep my cool in the face of the event and try to act rationally. I try to contact and get help from anyone who has previous experience with the event. I assign tasks related to the event to those who are involved in the event. I act serious about the event, but I also show the required flexibility when necessary". According to T11, "When I encounter an event involving chaos, I first check whether the event is seriously dangerous. If there is a dangerous situation in the event, I inform the school administration. I try to manage the situation until the necessary help arrives. However, if the event does not have a dangerous situation, I try to overcome it by solving the event. If it is a problem that can be resolved in a long time, I get help from people who have experience inside and outside the school". T17 stated, "When chaos occurs in the classroom, I try not to panic. I pay attention to the people involved. I try to understand and analyze the subject. I ask for help from the school administration. I ask for help from my teacher friends at school. I collect information about the event from students. During this whole process, I try to be more understanding by having a calm and moderate attitude". T22 said, "When faced with chaos in the classroom, the first thing I do is to stay calm. Then I identify the event and those who have an impact on the event. Afterwards, I give information to people related such as the school administration that I need to give information*

about the event and then I try to control the event. If I have to solve the event or take it under control, I struggle to solve the event without any problems, by bringing the wisdom to the forefront and getting help from people I regard as experienced".

Table 5: The effects of the butterfly effect on educational activities according to teachers

CATEGORY	CODE	PARTICIPANT	FREQ.
Academic Effect	Making unsuccessful students successful	T1,T2,T4,T6,T8,T9,T11,T 12,T13,T14,T16,T17,T18, T19,T21,T22,T23	17
	Developing new methods and techniques in teaching	T1,T3,T4,T5,T8,T9,T11,T 12,T13,T15,T16,T17,T18, T19,T21,T22	16
	Making learning more meaningful	T2,T4,T5,T8,T9,T12,T13, T15,T16,T18,T19,T22	12
	Ability to activate metacognitive thinking skills	T1,T3,T8,T9,T10,T14,T18 ,T19	8
Other Effects	Leading to leaps in every aspect of education	T1,T3,T4,T5,T6,T8,T9,T1 0,T11,T12,T13,T14,T16,T 17,T18,T19,T21,T22,T23	19
	Increasing responsibility and cooperation skills	T1,T2,T4,T8,T9,T11,T15, T17,T18,T20	10
	Helping managers to gain different perspectives	T4,T9,T13,T16,T21	5

When table 5 is examined, it is seen that teachers' views on how the butterfly effect can affect education are first grouped under two categories, *academic effect* and *other effects*, and then these categories are expressed in 7 different codes. In the research, the category of *academic effect* was coded as making unsuccessful students successful 17, developing new methods and techniques in teaching 16, making learning more meaningful 12, ability to activate metacognitive thinking skills 8, the *other effects* category was coded as leading to leaps in every aspect of education 19, increasing responsibility and cooperation skills 10, helping managers to gain different perspectives 5.

Some of the teachers' views on how the butterfly effect can affect educational activities are as follows. *T1 stated that "Butterfly effect can lead education into a dead end, but it can also lead to success in education. The important thing is to manage chaotic environments and turn even small problems into positive outcomes". T3 said, "Success in education can be achieved by overcoming ambiguities or solving problems. When the student who encounters a chaotic situation learns to deal with the problems with chaos, so s/he can overcome the problems s/he encounters in education. Thus, s/he can be successful in all areas and stages of life". T8 stated that "When some small problems or deadlocks in students are overcome by a mess or a chaos, this situation can cause huge leaps in the student. It can even develop positive results that are sometimes unpredictable". According to T11, "Butterfly effect enables the individual to overcome the problems. Especially in schools, teachers or administrators can develop their own strategies or methods in order to overcome the problems or troubles they encounter, especially those who encounter chaotic situations in schools". T17 said, "When the butterfly effect takes place in schools, school management and staff should take responsibility and cooperate in order to overcome this chaotic situation. They should develop some methods in order to be successful in the chaotic environments they may encounter later". T18 stated "Learning can be more successful and more meaningful in environments where the butterfly effect is observed. Especially, students living in chaotic environments, with the effect of the troubles they experience, become more sensitive about both the struggle in life and the duties that fall on them. This increases the success of the individual in life. This is also the case in some schools. In some schools, there are a lot of problems, but*

when the students of the school are examined, both the students and the school are very successful. What make the student and the school successful there is the butterfly effect in the school and the student's ability to find their way out of this chaos and the achievements that it brings."

4. Discussion and Conclusion

From the data obtained on the effect of chaos and butterfly effect on education and interviews with teachers, chaos is perceived as concepts such as fear, inconsistency, unpredictability, uncertainty, neglect, obscurity, darkness, surprise, bewilderment, inability to understand, confusion, ambiguity, irregularity, inconsistency, disorder, imbalance, disharmony, uncontrollable event or events, and disturbance. In the research, it was concluded from the interviews with the teachers that they had enough information about the concept of chaos, but that they did not have the expected effects on the chaos theory or the positive effect of chaos in education. In a study conducted by Hosokawa & Katsuri (2018), it was concluded that school administrators did not have enough knowledge in applying the chaos theory to education, so they found solutions to chaotic problems in intuitive ways.

The success of schools depends on the success of the students. Therefore, the success of all students in schools should be high. Students may have small problems and sometimes these problems can lead to student failure. In the research, it was concluded that being able to solve small problems or complexities can lead the student to unpredictable success. In their research, Hacicaferoglu, Hacicaferoglu & Secer (2015), it is seen that the students' anxiety due to the activities in the school environment affects their academic achievement. In a study conducted by Grant, Joen & Buettner (2019), it was concluded that chaotic classroom environments perceived by teachers negatively affect teachers' success and commitment to the profession. In a study conducted by Berger et al., (2017), it was concluded that chaotic situations in the classroom could weaken the communication between teachers and students. In a study conducted by Martin, Razza & Brooks-Gunn (2012), it was concluded that taking precautions against chaos in the family has positive effects on the development of the relationship between the parent and the child as well as the academic and behavioral development of the child.

Chaos also improves students' metacognitive skills by enabling students to develop different ideas in teaching. Students who solve chaotic situations by thinking can solve their problems more quickly by looking at problems from different points of views. In the research, it was concluded that the chaotic environments led the students to think and developed their ability to analyze events by looking at them from many different perspectives. In a study conducted by Hunter (1996), it was concluded that giving students the right to speak in chaotic environments prompted students to think and research.

According to teachers or administrators, chaos in education means a problematic situation. In the research, it was concluded that the problems encountered in education should be analyzed and resolved logically together with the students, and that determined, combative and successful students should be raised who can cope with the problems thanks to the struggle with chaos. It was concluded that chaos creates unexpected changes in students, allowing these students to exhibit unexpected performances and thus increasing their self-confidence.

The butterfly effect is that a small event in education can grow and unpredictably change the individual positively or help them to be successful. In the research, the butterfly effect was examined in terms of education and it was concluded that when the students experience chaos and the butterfly effect, it reveals the dynamics within the students and increase the student success, and as a result, the success of the school will increase. In a study conducted by Baker, (1995), it was concluded that the butterfly effect is always seen in school systems, and that especially school administrators should take decisions that can have huge effects on schools by using the butterfly effect theory.

In the research, it was concluded that teachers should be calm, think logically, act logically, try to manage the environment or situation when they encounter a chaotic environment in the classroom, get help from experienced people before making a decision about the event, communicate with the school administration, other teachers and students who know the event.

In the research, it was concluded that the most effective way to protect from chaos in education is to predict chaos may happen beforehand, to take responsibility for chaos and to see risks. According to Erturk (2012), the way to be protected from chaos is to work hard, to work selflessly, to see the future, to predict risks and to take responsibility. Schools are institutions intertwined with chaos. For this reason, school administrators and teachers may encounter chaos at school at any time. Therefore, employees should always be prepared for all kinds of surprises at the school. In a study conducted by Altun (2001), it was concluded that school administrators and teachers could encounter chaos in schools at any time, and therefore they should be ready to encounter chaos at any time.

4.1. Recommendations

Chaos can arise in educational environments at any time. Therefore, it is not known when the chaos will arise. For this reason, school staff, especially administrators and teachers, should receive training on how to behave in chaotic environments and how to manage chaotic environments.

Chaotic environments that may arise in schools should not be driven by intuition or emotions, but by creativity and chaos approaches. Managers should be more flexible in situations of chaos and have the understanding to maintain order.

Teachers should offer opportunities to unsuccessful students by considering that unsuccessful students in the classroom can be successful in the future or in time. Teachers should turn the seemingly negative situations into an advantage by turning them into opportunities thanks to the butterfly effect.

Seminars, symposiums or in-service trainings on chaos and its effects or chaos theories should be given to administrators, teachers and all other employees working in schools, and all employees should be educated on these issues. In addition, teacher candidates studying in education faculties of universities should be given courses on topics such as chaos, chaos theory and the butterfly effect, so that the candidates can cope with chaotic environments more easily when they start teaching.

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