EDUMASPUL
JURNAL PENDIDIKAN
Vol. 6 – No. 2, year (2022), page 2058-2062
| ISSN 2548-8201 (Print) | 2580-0469) (Online) |

Basis and Principles of Systematic Thinking in Education

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Receive: 07/08/2022	***Accepted: 27/09/2022***	***Published: 01/10/2022***

Abstrak

Penelitian ini merupakan penelitian studi pustakan yang mengkaji terkait dengan Alas Dasar Dan Prinsip-Prinsip Berpikir Sistematik Dalam Dunia Pendidikan. melatar belakangi perlunya berpikir sitematik dalam dunia pendidikan, hasil penelitian menunjukkan bahwa Dalam berfikir sistem, struktur (sekumpulan lingkar sebab-akibat) ini menentukan perilaku (behaviour atau dinamika) suatu fenomena. Lingkar sebab-akibat positif akan menghasilkan suatu perilaku pertumbuhan (growth) atau penurunan (peluruhan). Lingkar sebab akibat positif dikenal juga sebagai tipe loop Reinforcing atau digunakan notasi "R". Sedangkan lingkar sebab-akibat negatif akan menghasilkan suatu perilaku pencapaian tujuan (goal seeking) walaupun terkadang goal atau tujuan dalam lingkar itu tidak tampak secara eksplisit. Lingkar sebab akibat negatif merupakan pula suatu proses penyeimbangan (Balancing process) dengan menggunakan notasi "B".

***Kata Kunci**: Prinsip-Prinsip, Sistematik, Berpikir*

Abstract

This research is a literature study that examines the basic principles and principles of systematic thinking in education. background of the need for systematic thinking in the world of education, the results of the study show that in systems thinking, this structure (a set of causal circles) determines the behavior (behavior or dynamics) of a phenomenon. A positive causal circle will result in a growth or decline behavior. Positive causal loops are also known as Reinforcing loop types or use the "R" notation. Meanwhile, a negative causal circle will result in a goal-seeking behavior, although sometimes the goals or objectives in the circle are not seen explicitly. The negative causal circle is also a balancing process using the notation "B".

***Keywords:** Principles, Systematic, Thinking*

Introduction

As we all feel, progress in various fields today has given rise to various kinds of life problems that require resolution. In solving various kinds of problems, it requires a more integrative and structured approach to describe them (systemic thinking). Therefore, the systems thinking approach provides an alternative to complex problem analysis that focuses not only on problems in components, but on connectivity between components(Wardani 2003).

(Rositawati 2019)Systems thinking can lead us to enter a transition in seeing problems from not just looking at components, but also being able to see the relationships between components, then looking at

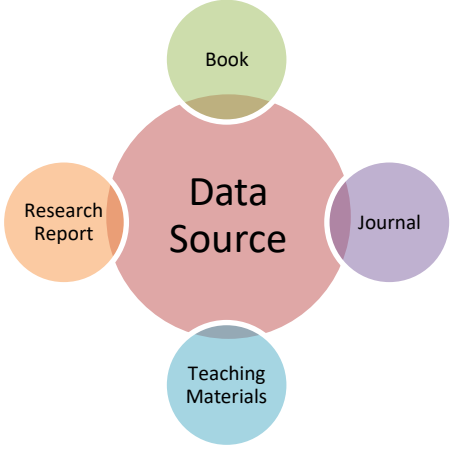
interconnecting relationships, until finally seeing the interdependent relationships between components. This ability allows humans to understand problems better, and better understanding can open up opportunities for better solutions.

Humans are social creatures who cannot live alone. In life, humans always interact with each other and with the environment. Humans live in groups both in large groups and in small groups. Not only the environment that needs to be managed properly, human social life also needs to be managed properly. For this reason, quality human resources are needed. Resources that have the spirit of a leader, at least to lead themselves. With the spirit of human leaders will be able to manage themselves, groups and the environment well. Especially in dealing with relatively complicated and difficult problems. This is where the wisdom of a leader is required in making decisions so that problems can be resolved properly.

In thinking of this system, it can also be seen that there is a single unit consisting of components such as superiors, subordinates, colleagues, and other related parties. However, it should be realized that one component part will not be able to stand alone in achieving organizational goals. In this case, good interaction, cooperation, and communication between components, between leaders, subordinates, colleagues, and others, is absolutely necessary.

Method

Literature research is a research method where in the process of searching, collecting and analyzing data sources to be processed and presented in the form of a library research report with a variety of topics that are needed, both educational, socio-cultural, and others. the library research process is carried out by reviewing the literature and analyzing the relevant topics that are combined. Bibliography searches can take advantage of sources in the form of journals, books, dictionaries, documents, magazines and other sources without conducting field research.



Picture 1. Research Data Source

Result And Discussion

Systems Thinking Theory

According to Hidayatno, thinking is a mental activity in an attempt to acquire knowledge. Therefore, thinking is a cognitive process that cannot be seen physically. The results of thinking and even then are abstract in the form of ideas, knowledge, procedures, arguments, and decisions. According to Banathy, he said that systems theory is an organized expression of a series of interrelated concepts and principles that apply to all systems. There are two groups of approaches in defining a system. Meanwhile, Salamun asserted that the system is a set of elements that are related to each other which form a certain function.

According to Ackoff, in principle, systemic thinking combines two thinking skills, namely the ability to think analytically and think synthetically. Meanwhile, according to Hurliman said that Systemic thinking emphasizes more on awareness of everything related in a series of systems. The pattern in thinking is the opposite of fragmented-linear-cartesian thinking. Rohmadi stated that the process of system thinking will give birth to a thought which will have an effect on an action or behavior. Meanwhile, according to Adetary, system thinking has an impact on a series of thoughts that form a person's thinking habits (Mindset) or a person's perspective as an implication of understanding an object of thought in responding to a problem. So Mindset is a belief (belief),

From some of the understandings put forward by the experts above, it can be concluded that systems thinking is one of the approaches needed so that humans can see the problems of this world more thoroughly and thus decision making and choices of action can be made more focused on the sources of the problem. which will change the system effectively.

Systems Thinking Concept

In 1994 George Richardson in "Systems Thinkers,SystemsThinking" shows that the idea ofthinksystematically on a problem has a long history in various fields. Richardson said the termsystems thinkingonly started to be used in the fieldsystemdynamics of the late 1980s. In the special issues of the "Systems Dynamic Review" for a decade there has not been a clear definition of systems thinking that is accepted by the entire systems dynamic community, so Richardson developed a project to examine all the attributes of systems thinking. Until the endsystems thinkingstarted to be implemented in all schools over the last 20 years.

Here are some things about the concept of systems thinking, namely:

1. Approach*systems thinking*involves the following principles:
   a) *Holism*– the thought thatsystemmust be viewed as a whole.
   b) *Inputs and outputs*-insystem In a closed system, the input is determined once and is constant, while in an open system there are additional inputs that come fromenvironment
   c) *Entropy*–a unit for measuring abnormalities that exist in asystem
   d) *Hierarchy*–something complex is made up of several smaller subsystems
   e) *Goal seeking*–a systemic interaction must have the same goal or end condition
   f) *Regulation*-method feed back much needed so that system works as expected
   g) *Equifinality*–alternative ways to achieve the same goal
   h) *Multifinality*–achieve alternative goals from the same input
   i) *Differentiation*–specialized units have specialized functions as well.
   j) *Dualism*-duan character system contradictory but very important for a system
   k) *Modularity*–separate or combine elements of system according to the relationship
   l) *Abstraction*–the process of removing a characteristic system to define the basic characteristics.
   m) *Relation*–the relationship between elements in asystem
   n) *Encapsulation*-hide elements system and the interaction ofenvironment external.
2. Characteristics ofSystemsthinker
   a) Thinkas a whole rather than in parts
   b) Seeing things in the bigger picture
   c) Finding out the effects of aaction
   d) Identify how a relationship can affectsystem
   e) Understand draft from behavior dynamic
   f) Understand how to structure system shape behavior system
   g) Seeing things from a different point of view
3. Use of Systems Thinking

systems thinkinghas been used to solve many problems from various fields such asanalysis business, management business, health, computing, manufacturing, development sustainable, epidemiology and others.

Systems thinking uses computer simulations, various diagrams and graphs to model, illustrate and predict system behavior. Examples of systems thinking tools are a behavior over time (BOT) graph that shows the actions of one or more variables over a certain period of time, a causal loop diagram (CLD) that depicts the relationship between elements in a system, a management flight simulator that uses interactive programs to simulate the effects of management decisions, and simulation models that simulate the interactions between elements in the system over time.

Systems Thinking Principles

Thinking is the process of answering questions. Systematic thinking is the ability to think to do tasks according to the right, effective and efficient sequence, stages, steps, or planning. By thinking logically and systematically, you can solve problems better.

Systems thinking is a process to understand a phenomenon by not only looking at it from one or two particular sides. In thinking of this system, it can also be seen that there is a single unit consisting of components such as superiors, subordinates and other related parties.

Operationally from the words that we often encounter when talking about systems thinking, namely system, systematic, systemic. The system is an integration between elements that interact with each other, integrate, share, synergize and collaborate for a certain purpose, with a certain metabolic mechanism process, with a certain product target and time of achievement, with a control mechanism for planning, implementing and evaluating continuously, being open. , has certain limitations and is or is related to a certain environment.

The system can have many purposes, and it can also be the same goal, is the goal of many systems. The core feature of the system is that it is oriented towards the goal of the system, which is to create or achieve something of value, something that has value. Whatever its form and what size is valuable or valuable. The creation and achievement of something valuable is done by combining and utilizing various kinds of materials in a certain way as this example shows the various materials used by the system to achieve its goals: Cars (Gasoline, Oil, Water), Humans (Food, drinks, clothes, etc.) Books), Schools (People, Facilities, Infrastructure).

As already mentioned, that the purpose of a system can be more than one, in other words the system can have multiple goals, of the many goals of the system, maybe one of them is the most important goal, the most basic goal, or one that gets priority to achieve .

Then the basis used to determine a prioritized goal of course varies. And there are four benchmarks or criteria for choosing the importance of a goal, namely:6quality, quantity, time and cost. Because people choose something based on quality, quantity, time and low cost.

System Restrictions

A system if you want to be said to be a system must have a boundary that separates it from the

environment, so that with the concept of understanding system boundaries it is possible to pay special attention to a system in the system hierarchy, and the system boundaries can be physical or conceptual, such as an alarm clock, for example, the boundaries. clear and physical, while social groups do not always have physical boundaries.

A system has certain limitations to distinguish the components of the system from one another. With system boundaries, it will be easy to know the elements that are part of the system components such as: system boundaries, system environments, environmental elements and sub systems. In this case as stated by Claggett & Karahanna, that the system boundary is defined as follows:

1. List all the components that make up the system and give the boundaries that surround them. All content within this constraint is called the system, and all external content is called the system environment.
2. Record all currents that cross the system boundary, the flow from the environment into the system is called input (input), and the current from inside the system to outside the system is called output.
3. List all elements that contribute to the system's specific goals and include them within the system constraints (if not included), (Claggett & Karahanna, 2018)

Systems Thinking Model

Along with the development of the times, the problems faced will be more and more difficult, coupled with the fact that between problems can be intertwined with each other in a complex network of problems. These problems cannot be solved by relying solely on one area of expertise, but we must also fundamentally change the way we view these problems.

The following will discuss several other models that help build systems thinking, namely logical, critical and holistic thinking. The various definitions, with some even being discussed in depth in a book such as critical thinking or thinking, make the descriptions that will be given in this section more concise and general.

a. Logical Thinking

Logical thinking can be defined by the ability to connect two or more components or factors in a relationship that is generally accepted as valid argument. A definition that differs from textbooks and you may not agree with given the long history of the concept of logic. Recorded history began the approach to logic in the time of Aristotle and developed into various variations of logic, including mathematical logic which plays an important role in today's computer programming languages.

But simply in systems thinking, logical thinking helps free oneself from imagination that is too wild that leaves plausibility, when analyzing a problem. Without logical limitations, daydreams would be impractical or down-to-earth and have no difference from delusion.

Logical thinking based on argument processing will help us in getting the other person to agree with us, a process that is also important in systems thinking. Thinking logically with disciplined argument sequence, also makes it easier to do systems thinking, because the components of the argument must be arranged in such a way that logically it can be accepted.

b. Critical thinking

Critical thinking is at the heart of modern education. A process for conceptualizing, analyzing, or synthesizing information obtained from various sources as a guide for acting or making decisions. Critical thinking process is an argumentation process in the form of question and answer to a claim. A strong argument must be based on strong thinking and reasoning and have a logical structure that makes sense. Strong judgments can be based on analogies, numerical data, generalizations and causal relationships (Epstein and Kernberger 2006).

What is often misunderstood in the media about the word "critical" is the meaning of negativity or disapproval. This misinterpretation is the result of using critical thinking to argue a claim. The debate is carried out to reject or defend a claim through a logical structure of a combination of facts, experience and imagination.

The simplest and most common structure used in constructing an argument is 5W+1H (What, Why, Where, When, Who and How – What, Why, Where, When, Who and How). However, more complex structures can be used and various techniques can be used to justify or contradict an argument.

It is this orientation to the argument that makes critical thinking sometimes not suitable for use in a good problem solving process. The element of subjective interest is often counterproductive in finding the root cause of the problem.

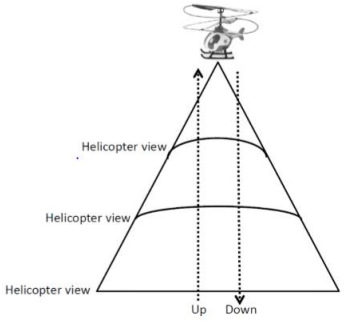
The most important component in critical thinking in developing systems thinking patterns is the process of compiling relevant argumentative questions in a logical structure. A similar process will lead us to the definition of systems thinking. Another component that supports is the drive to have a healthy curiosity (curiosity) to collect relevant information, Curiosity that requires an open mind to the assumptions, implications and consequences of something important

in systems thinking, so critical thinking becomes one of the important components in the formation of systems thinking.

c. Holistic Thinking (Helicopter View)

*System Thinking*or systems thinking is one approach that can be used to view problems more holistically (Ngili, 2016). Holistic comes from holism, which is an understanding that a system cannot be viewed from its parts or sub-systems only. By thinking systems, we as humans can look at the existing problems more thoroughly, so that in making a decision and choice of action can be made more focused on the sources of problems that will change the system effectively.(Sulistiani and Masrukan 2017).

Systems thinking does not break down complex problems into simpler ones, but looks at it from a greater distance so that complex interrelationships between sub-systems can still be seen. One of the tools that can be used for systems thinking is HelicopterView.



Picture 2. Thinking Helicopter System View

(Amrullah et al. 2018) As the name implies, helicopter view is one approach in looking at a problem by looking from above, as if looking at the point of view of a helicopter flying. The flying height of the helicopter can vary, from low to high altitude. The higher the helicopter flies, the greater the downward visibility. By looking from a higher place, the system will be clearly displayed holistically. For that, the general picture of an environment will be easily mapped. If it drops even lower, the independent and dependent variables will be clearer.

The use of helicopter view realizes that in an environment, there are various levels at once from the smallest to the abstract (micro – macro – meso). When there is a problem, the solution that may be sought may only be limited to the micro level, but the solution still cannot solve the problem. This happens because there is still a possibility that the root of the problem is not at the micro level, but at the macro level. Because of this, helicopter view can be used to holistically view a fast-moving environment (Edson, 2008). If we can map the parts of a system, then our perspective on a problem can be more comprehensive, so that decision making can be more effective.

Systems Thinking Paradigm

In the systems thinking paradigm, a cause-and-effect relationship that has polarization is depicted by using arrows with a positive (+) or negative (-) sign on the left or right of the pointed end. A positive arrow can mean that the cause will increase the effect or the cause will affect the effect in the same direction of change (the influence of other variables on the effect, if any, is considered non-existent).

The same direction of change means that if the cause increases (or decreases), its effect on the effect will cause the effect to increase (or decrease as well). While a negative arrow can mean that the cause will reduce the effect or the cause affects the effect in the opposite direction of change (the influence of other variables, if any, is considered non-existent). The opposite direction of change means that if the cause increases (or decreases), its effect on the effect will be the opposite i.e. cause the effect to decrease (or increase).

(Dupni and Rosadi 2021)The systems thinking approach has tools known as system archetypes that are useful for recognizing system behavior patterns. Each archetype depicts a story line with its own theme, specific behavioral patterns can be described and unique system structures can be described with a causal loop diagram (CLD).

In systems thinking paradigm, this structure (a set of causal circles) determines the behavior (behavior or dynamics) of a phenomenon. A positive causal circle will result in a growth or decline behavior. Positive causal loops are also known as Reinforcing loop types or use the "R" notation. While a negative causal circle will result in a goal-seeking behavior (goal seeking) although sometimes the goals or objectives in the circle do not appear explicitly. The negative causal circle is also a balancing process using the notation "B".

The next stage after forming a cause-and-effect diagram is to make the behavior of some of the key elements of the structure. Phenomena that are visible and visible in events in the real world are events that can be seen and felt. These events in the perspective of time will then produce a pattern of behavior (behavior over time/BOT) which is formed from the structure of the problem made in the form of a causal loop diagram (CLD). BOT contains the behavior of variables or elements in the past and estimates of the behavior of variables or elements in the future if they do not make any changes.

Conclusion

Systems thinking is one of the approaches needed so that humans can see the problems of this world more thoroughly and thus decision-making and action choices can be made more focused on the sources of problems that will change the system effectively.

There are several other models that help build systems thinking, namely logical, critical and holistic thinking. The various definitions, with some even being discussed in depth in a book such as critical thinking or thinking, make the descriptions that will be given in this section more concise and general.

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Reference

Amrullah, Silmi et al. 2018. "Studi Sistematik Aspek Kreativitas Dalam Konteks Pendidikan." *Psympathic : Jurnal Ilmiah Psikologi* 5(2): 187–200. http://journal.uinsgd.ac.id/index.php/psy/article/view/3533.

Bungsu1, rajo & Imron, Kemas Rosadi. 2020. *Faktor Yang Mempengaruhi Berpikir Sistem: Aspek Internal Dan Eksternal.* Volume 2, Issue 2.

Dupni, Dupni, and Kemas Imron Rosadi. 2021. "Faktor Yang Mempengaruhi Berpikir Kritis Dalam Tradisi Kesisteman Pendidikan Islam Di Indonesia. Jurnal Manajemen Pendidikan Dan Ilmu Sosial." *Jurnal Manajemen Pendidikan Dan Ilmu Sosial* 2(1).

Gordon B. Davis, Managemen *Information System, Conceptual Foundations, Structure, And development*, Aukland : Mc. Graw Hill, 1974

Hidaytno, Ahmad, 2013. Pdf Berpikir Sistem: Pola Berpikir untuk Pemahaman Masalah yang lebih baik See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/302412744.

Mesiono. (2022). Model of Education Management using Qualitative Research Methods at a Private School in Medan. *Educational Administration: Theory and Practice*, *28*(2). https://doi.org/https://doi.org/10.17762/kuey.v28i02.450

Nggili, R. A., (2016). Pendekaran *System Thinking* dalam Kepemimpinan Transformasional. *Jurnal Humaniora Yayasan Bina Darma, III,* hal. *169-183*

Salamun. (2017). Sistem Monitoring Nilai Siswa Berbasis Android : : Jurnal Teknologi Dan Sistem Informasi Univrab, 2(2), hal. 99–109.

Sulistyowaty, Anny. (2012). *Modul Pelatihan Cara Berpikir Sistem. Behaviour Over Time Graph*. Yayasan Kuncup Padang Ilalang, Bandung,Juli 2012. Hal.7-8

Sulistyowaty, Anny. (2012). *Modul Pelatihan Cara Berpikir Sistem. Behaviour Over Time Graph*. Yayasan Kuncup Padang Ilalang, Bandung, Juli 2012. Hal.7-8

Rositawati, Dwi Nugraheni. 2019. "Kajian Berpikir Kritis Pada Metode Inkuiri." *Prosiding SNFA (Seminar Nasional Fisika dan Aplikasinya)* 3: 74. https://jurnal.uns.ac.id/prosidingsnfa/article/view/28514.

Sulistiani, Eny, and Masrukan Masrukan. 2017. "Pentingnya Berpikir Kritis Dalam Pembelajaran Matematika Untuk Menghadapi Tantangan MEA." In *Prosiding Seminar Nasional Matematika*, Semarang: Universitas Negeri Semarang, 605–12. https://journal.unnes.ac.id/sju/index.php/prisma/article/view/21554.

Wardani, Laksmi Kusuma. 2003. "BERPIKIR KRITIS KREATIF (Sebuah Model Pendidikan Di Bidang Desain Interior)." *Dimensi Interior : Jurnal Dimensi Interior* 1(2). https://dimensiinterior.petra.ac.id/index.php/int/article/view/16238.

Zaini, M. F. (2020). *Kontribusi Rekrutmen, Pemberian Hadiah dan Hukuman Terhadap Produktivitas Kerja Guru di MTS N Negeri Medan*. Universitas Islam Negeri Medan.