

TCT 201: INSTRUCTIONAL TECHNOLOGY

Topic: Systems Approach and Their Applications in Education

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Objectives

At the end of this lecture the learner should be able to:

- a) Define the term system.
- b) Identify components of a system.
- c) Explain characteristics of a dynamic system.
- d) Explain the application of systems approach to classroom teaching and learning.
- e) Describe systems approach models
- f) Explain applications of systems approach in education.

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Definition of the term System

- Roiszowki (1981) defines a system as a set of elements or components or objects which are interrelated and work towards an overall objective.
- Groenewegen (1993) defines a system as a complex of factors interacting according to an overall plan for a common purpose.
- A system can be defined as a set of component which each perform its own unique task but all work in synergy to achieve a common objective or goal/mission

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Definition of the term System

- Common examples of systems in our day to day lives are:
 - **Human Body Systems:** in our bodies, we have system such as digestive, circulatory, nervous etc.
 - **Mechanical Systems:** - For examples refrigeration systems, generator system, computer systems and different types of engines.
 - **Social systems:** These include such organizations as a family, educational systems, political parties, trade unions movements, industries, churches etc.
 - **Natural systems:** For example physical features such as river, forests etc.
- NB: A system has an objective or goal/mission to be achieved

Types of Systems

- A system can either be open or closed system
- An **open system** is one which can interact with its environment
- An open system demonstrates a phenomenon called **principle of equifinality** which states that an open system can reach its final state in a number of different ways because it can interact with its surroundings by receiving ideas and inputs from the environment (society) and gives back to the same environment

Types of Systems

- A **closed system** is one, which operates in isolation from its environment. It does not get any input from its surroundings. Its final state is dependent on its initial state.
- NB:** Most systems are open since it is difficult to completely isolate a system from all outside influences.

Components/Elements of a System

- Generally a system is distinguished by the following components:-
- a) **Goals** – Every system has a goal which is the target to be achieved. All members work towards the achievement of the goal
- b) **Elements** - there are more than one elements in a system. The elements in a system are interrelated and interacting subjects.

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Components/Elements of a System

- c) **Harmony** – there is coherent interaction for achieving the common goal – elements work in synergy. The elements work in harmony, but each has its own function which it contributes in achieving the goal of the system.
- d) **Feedback** - a provision for assessing the quality of the success level in the interaction leading to the attainment of the intended goal.

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General Characteristics of a system

- a) **Goals and mission** – each system works towards a specified goal or the accomplishment of a given mission.
- b) A system exists in a **hierarchy of relationships**. Each functional unit forms sub-systems with elements that cannot work independently, otherwise, such a system is a supra system. A **supra system** is one that has subsystems each of which has a measure of performance but is independent on other sub systems e.g the universe, the human body, etc

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General Characteristics of a system

- c) A system has **boundaries** which distinguish such part from the other parts of the system thus ensuring that a specific task is performed at a particular point, yet both parts depend on each other.
- d) Each system has **environment**. This consists in a set conditions that are relevant but not directly under the influence of the system usually environment of a system contains the resources and constrains.

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General Characteristics of a system

- e) Systems are **likened to livings things** because they receive input and act on them to produce output and are capable of growth. In this context, open system receive ideal inputs from the environment. There is always some degrees of disorders. System objectives operate within constrains and there is a critical point at which the system may collapse. There is thus a need to ensure flexibility in operational objectives of a system to minimize entropy (moving from order to disorder).

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General Characteristics of a system

- f) **Feedback** – this is specific input into the system that gives information about the achievement (output) for purposes of re-examining the system.
- g) **Growth** – a system grows through either transformation or diversification or multiplication.
- h) **Dynamic stability** – each system is dynamically in harmony with the environment and exhibit levels of balance among its elements or sub-systems based on common expectations.
- i) **Equifinality** –The same final point or system outputs can be reached from various starting or original points or initial conditions.

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The Environment of a System

- Every system has an environment in which it operates. This is a set of all objects, a change in whose attributes affect the system and also those objects whose attributes are changed by the behavior of the system of the system.
- According to Richey (1986) a system is a complete whole and functions as part of a larger system or environment referred to as the **supra systems**.

The Environment of a System

- Richey argues that the supra system and the immediate environment makes up the entire environment.
- Within the target system, there are sub-systems with organized and identifiable structures whose purposes and functions are limited to the target system itself.
- The ultimate function of a system is necessarily determined by the component processes operating with the target system.
- There is a flow both inward and outward the system into the environments

The Environment of a System

- In order to survive, the system must interact with and adjust its environments and the other parts of the supra system.
- Richey further argues that, there is a relationship between the system and its environment such that:-
 - a) Environment provides the input such as money, people; resources etc which enter the system and which will be a great extent determine the quality of the operation of the system.
 - b) The environment and the supra system establish the constraints such as inadequate material upon the system.

The Environment of a System

- c) The supra system receives the product of an open system which becomes a functioning parts of the environment, thus influencing the operation of the supra system.
- d) The environment consists of resources and constraints that affect the system either positively or negatively realized through its products.
- e) Each system has a dynamic stability (equilibrium) with the environments and exhibits various levels of balance among its elements based on condition expectations and goals.

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Application of the Concept of System in Education

- According to Hooper (1971) education is a system because it has a set of inputs (money, students, etc) which are subjected to a process in orders to attain certain objectives which appear as outputs (educated students).
- Further, education can be viewed as a system because of self adjusting combination of interacting people and things designed by humans to accomplish some predetermined purpose

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The School as a System

- From the foregoing can a school be considered as a system?
- The answer is yes, the concept of a system is applicable to the school organization because of the following characteristics:
 - a) **Goal** – the school receives raw materials (the learners) whose behavior is transferred through the process of education. The output is then of adults whose behavior has been transformed and the quality of this transformation has been accepted by quality controller.

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The School as a System

- The school receives its goal from the society. Society is the environment as well as the supra-system of schooling from which the school receives its goal.
- In Kenya, most of these long term goals come from the ministry of education and will therefore, be stated in schools syllabuses or educational reports. The teachers with the help of other school operators have the duty of discerning, defining objectives of different subjects.
- These long term goals include the National Goals of Education defined in a country education system. In Kenya, the national goals of education are:

The School as a System

- i. Foster nationalism, patriotism and promote national unit
- ii. Promote social, economic, technological and industrial needs for national development
 - Social needs
 - Economic needs
 - Technological and industrial need
- iii. Promote individual development and self-fulfillment
- iv. Promote sound moral and religious values
- v. Promote social equality and responsibility

The School as a System

- vi. Promote respect for and development of Kenya's rich and varied cultures
 - vii. Promote international consciousness and foster positive attitude towards other nations
 - viii. Promote positive attitude towards good health and environmental protection
- Whatever is done in the system must address these goals.

The School as a System

- b) **Elements** – They include head teachers, BOM, PTA, teachers, learners, teaching/learning resources, physical facilities, non teaching staff, etc. the operators of the school should be able to interact with each other as well as the learners so as to move from an input condition of original or entering behavior to an output condition of modified behavior. All these elements are part of education system.
- c) **Harmony** – for the goals to be realized the elements all those involved in the education process must work harmoniously otherwise the goals will not be

The School as a System

- realized if one element is out of control.
- The head teacher as an administrator must provide effective administration. The teachers’ task is to facilitate learning. He has to establish conditions, which make it possible to achieve effective learning. The teacher should teach in class the right material at the right time. Teachers should provide an environment with optimum conditions of learning.
 - The learners must work harmoniously with their teachers, head-teachers and support staff for learning and teaching to be effected. The learners must be disciplined because lack of order will disrupt learning

The School as a System

- and therefore the attainment of goals.
- Support staff must perform their respectful roles e.g. cooks, nurses, cleaners etc. must do their parts.
 - d) **Feedback** – Both the teachers and the learners need to get feedback from the learning process to test whether the products are being processed in the desired way. The feedback can be positive or negative. If feedback is positive; the teacher will be encouraged to continue knowing that he/she is in course. If the feedback is negative, the teacher will have to apply quality control – by adjusting his teaching methods, resources, approaches and class management to have the learners back in the track.

The School as a System

- In summary, school as system has:
 - a) Goals – from the society
 - b) Elements – include teachers, students’ resources, physical facilities etc.
 - c) Harmony – evidenced by working together of all in the school.
 - d) Feedback – obtained through evaluation of all the school activities can be positive or negative.

The School as a System

- As stated earlier, a system approach is applied in everyday life situation consciously or sub consciously, however, in education, we have to make effort to apply the concept consciously to enable all concerned to reap all inherent benefits in the approach.

Relevance of Systems Approach in Teaching and Learning

- Mukwa (1979) defines systems approach as a process by which, needs are identified or problems and requirements for the problems solutions are selected from alternatives, methods and means are obtained and implemented, results are evaluated and required revisions to all or part of the system are made so that the needs are eliminated.

Relevance of Systems Approach in Teaching and Learning

- Kaufman (1970) summarizes systems approach in two words: analysis and synthesis, where analysis related the identifying component parts and determining the relationships among those parts and between the parts and the whole system. Synthesis on the other hand involves the design of a raw system so that the identified problem can be solved.

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Relevance of Systems Approach in Teaching and Learning

- We can therefore conclude that system approach is scientific in nature, is orderly, is a process or procedure, has elements which are interrelated and has a purpose to fulfill.
- We can also conclude that our school programme qualifies to be considered as an example of a system.

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SIMPLE MODEL OF A SYSTEM APPROACH

- A model can be defined as an abstract representation of reality.
- A model is a picture or a pictorial representation that effectively tells us at a glance how the systems approach works.
- The simplest technological model also referred to as the linear model consists of three basic elements: - **Input, process and Output.**
- This is diagrammatically represented as shown.

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SIMPLE MODEL OF A SYSTEM APPROACH



Learner who is ignorant of the content to be covered at this level. However, the learner has some entry behaviour which is expected to be improved through the teaching/learning process. Such entry behaviour may include:

- Background experiences
- Knowledge
- Skills
- Values
- Attitudes
- Behaviour, etc

The process is the teaching/learning process. It is facilitated by the teacher. The teacher may be qualified or unqualified, experienced or inexperienced, enthusiastic or dull. The teachers chooses the teaching method, resource materials, learning activities, evaluation procedure, etc

The output is an educated person who is highly knowledgeable (facts, laws, processes, concepts, ideas, etc), highly skilled (Intellectual, motor, social, affective, observational, logical, lanaguage skills etc), has postive attitude and behaviours dtermined by the exam grades (certificate, exam grades, employer, parents, teachers, community, etc)

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SIMPLE MODEL OF A SYSTEM APPROACH

- The above illustration reveals that if you want to produce some new product, you have to carry out certain processes on the original material.
- In the case of education, learners are the inputs who are put in the Educational system.
- They are then processed at different levels of Education, finally coming out as educated individuals (output of the system).

NB: Here, the model does not say anything about the quality of the product.

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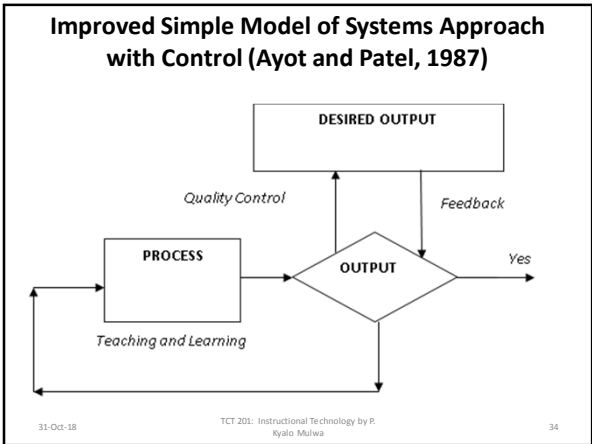
SIMPLE MODEL OF A SYSTEM APPROACH

- It is obvious that anybody undergoing a process will come out as a changed person
- In education we need to know or see the effect of the changes
- To be able to accommodate the element of product quality, Ayot and Patel (1987) improved the simple model to include elements of quality control.
- They did this by adding some more elements such as **specification of the desired output, checking actual output against expected output and processing the unaccepted output.**

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Improved Simple Model of Systems Approach with Control (Ayot and Patel, 1987)

- In this model, results of the process are checked through the feedback mechanism. The actual output is evaluated against the expected output. If does not measure up to the specified standard, it will go back through the process. Despite this, there is still one snag, teaching- learning is a dynamic process, but in the model the element process is like a dark box. No one knows what is going on inside the box.

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Improved Simple Model of Systems Approach with Control (Ayot and Patel, 1987)

- If we consider the box (process) represents a classroom teaching – learning programme, then it is under the control of the teacher, who plans his approaches, uses the necessary to check the final product, modifies his approach on the basis of feedback, and makes sure that the quality meets the required standard.
- This model needs to add checks and balances in the process.

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Improved Model with Check and Balances

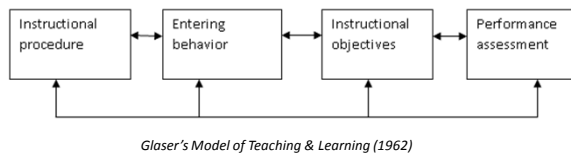
- There are other educationists who have developed models of system approach.
- They have done this with some modification because it is difficult to implement the idea of the system approach in education without proper understanding.
- One such educationist is Robert Glaser (1962) who has accommodated the ground rules of a system but his model is different from the input-process-output model. He has come out with four major elements in his model.

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Improved Model with Check and Balances by Robert Glaser (1962)



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Improved Model with Check and Balances by Robert Glaser (1962)

- If you want to make sure whether this model follows a system approach or not, we have to check against those basis criteria.
 - **Goal** – instructional objectives are to be formulated.
 - **Elements** – it has four elements.
 - **Harmony** – reversible arrows, suggests that there is inter relationship among elements.
 - **Feedback** – performance assessment provided feedback to the elements.
- To teach a specific part of the content following this model, one will have to check with learners present knowledge or their performance level

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Improved Model with Check and Balances by Robert Glaser (1962)

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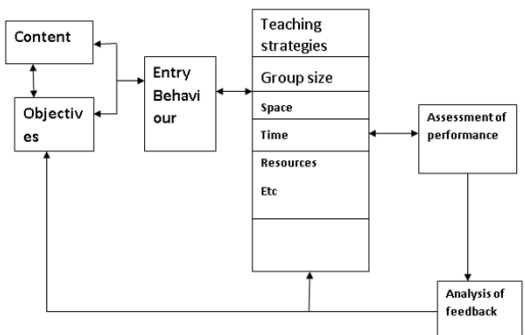
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Improved Model with Check and Balances by Vernom Gerlach and Donald Ely (1971)

- In this model the elements are arranged in such a way that one can see the integration among them, Gerlach and Ely have retained the concept of the Glaser model's four elements, but they have added some elements.
- For you to make use of this model requires that you specify the objectives which should be realized by teaching a given topic.
- Based on objectives, the content will be selected or vice versa.

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Improved Model with Check and Balances by Vernom Gerlach and Donald Ely (1971)



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Improved Model with Check and Balances by Vernom Gerlach and Donald Ely (1971)

- In order to know where the learning has to start, the knowledge level of the learner in relation to the content has to be determined, for instance, you have to find out what the learner knows about the content to be taught or the experience he has about that content.
- This will be the starting point of learning as you progresses from known to unknown.
- The entry behavior will influence and will turn be effected by the teaching strategies that you choose to use, the type of group organization and the time allocated for the content to be taught.

Improved Model with Check and Balances by Vernom Gerlach and Donald Ely (1971)

- The learning space available is important in determining the effectiveness of the teaching method adopted.
- The content and objectives will further influence your selection of resources to be used in teaching for the achievement off the stated objectives.
- At every stage of the learning/teaching process, evaluation is done.
- This is meant to check whether or not the content is being learnt and objectives are being achieved. If there is any dissatisfaction, then the process has to start all over, that is, after analyzing feedback, the product has

Improved Model with Check and Balances by Vernom Gerlach and Donald Ely (1971)

to go back to the process, or objectives have to be re-stated again, content selected a fresh the entry behavior determined, teaching strategies arranged etc before assessment is done again.

- Double arrows between content and objectives show that content can influence objectives and vice versa. The same applies to entry behavior and assessment of performance and related elements.
- Thus Gerlach and Ely’s model meets the requirement of a system approach.
- Teaching and learning is done systematically using the syllabus which specify the objectives of each content

Improved Model with Check and Balances by Vernom Gerlach and Donald Ely (1971)

taught and which must be related to the goals of education.

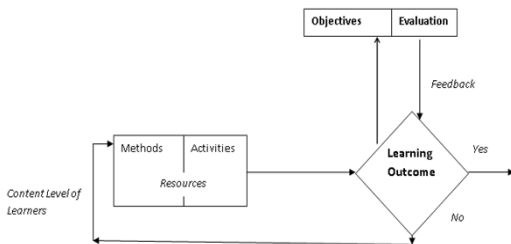
- In conclusion we can consider a model which is different from the Glaser's and Gerlach & Ely's models and is recommend for use by teachers while applying systems approach to teaching and learning.

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A Model Showing the Application of System's Approach Teaching and Learning



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A Model Showing the Application of System's Approach Teaching and Learning

- In this model, technical terms are translated into educational and more familiar words, which make it easier for teachers to understand
- The model is applicable to the education system as a whole or to teaching of a unit or even to a single lesson.
- The most crucial part of this system, which differentiates it from other systems, is the sharing of a box by objectives and evaluation
- This element is the same as the quality control elements of any science and technological system.

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A Model Showing the Application of System's Approach Teaching and Learning

- You exactly know what you want to produce since the specifications of the standard outcome are described or decided in every detail.

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Exercise

1. Define the term system.
2. Show how the concept of a system is applicable to the school organization.
3. Discuss at least five general characteristics of systems and explain how they apply to the teaching of your subject.
4. Define systems approach
5. Why is it important to consider the following elements in the teaching/learning process?
 - a) Entry behavior
 - b) Instructional procedures

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Exercise

6. Some secondary schools in this country are known for producing reliable and responsibility citizen, while others produce social misfits and deviants. To what extent would you attribute the differences of the two types of schools to their respective elements
7. Discuss system approach models used in teaching and learning
8. The Gerlach & Ely's model has stood the test of time and continues to serve the classroom teachers well. Discuss.

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