8. Schema of thought.

8.1 FORMATION OF SCHEMAS OF THOUGHT:

In psychology and cognitive science, a **schema** (plural *schemata* or *schemas*) describes an organized pattern of thought or behavior that organizes categories of information and the relationships among them. It can also be described as a mental structure of preconceived ideas, a framework representing some aspect of the world, or a system of organizing and perceiving new information. Schemata influence attention and the absorption of new knowledge: people are more likely to notice things that fit into their schema, while re-interpreting contradictions to the schema as exceptions or distorting them to fit.

Schemata have a tendency to remain unchanged, even in the face of contradictory information. Schemata can help in understanding the world and the rapidly changing environment. People can organize new perceptions into schemata quickly as most situations do not require complex thought when using schema, since automatic thought is all that is required.

People use schemata to organize current knowledge and provide a framework for future understanding. Examples of schemata include academic rubrics, social schemas, stereotypes, social roles, scripts, worldviews, and archetypes. In Piaget's theory of development, children adopt a series of schemata to understand the world.

History

Before psychology separated from philosophy, the term "schema" was prominently discussed in philosophy by Immanuel Kant. Early developments of the idea in psychology emerged with the gestalt psychologists and Jean Piaget: the term "schema" was introduced by Piaget in 1926.

The concept was introduced into psychology and education through the work of the British psychologist Frederic Bartlett, who drew on the term body schema used by neurologist Henry Head. It was expanded into schema theory by educational psychologist R. C. Anderson. Since then, many other terms have been used to describe schema, such as including "frame", "scene", and "script".

Schematic processing

Through the use of schemata, a heuristic technique to encode and retrieve memories, the majority of typical situations do not require much strenuous

processing. People can quickly organize new perceptions into schemata and act without effort.

However, schemata can influence and hamper the uptake of new information (proactive interference), such as when existing stereotypes, giving rise to limited or biased discourses and expectations (prejudices), may lead an individual to "see" or "remember" something that has not happened because it is more believable in terms of his/her schema. For example, if a well-dressed businessman draws a knife on a vagrant, the schemata of onlookers may (and often do) lead them to "remember" the vagrant pulling the knife. Such distortion of memory has been demonstrated. (See Background research below.)

Schemata are interrelated and multiple conflicting schemata can be applied to the same information. Schemata are generally thought to have a level of activation, which can spread among related schemata. Which schema is selected can depend on factors such as current activation, accessibility, and priming.

Accessibility is how easily a schema comes to mind, and is determined by personal experience and expertise. This can be used as a cognitive shortcut; it allows the most common explanation to be chosen for new information.

With priming, a brief imperceptible stimulus temporarily provides enough activation to a schema so that it is used for subsequent ambiguous information. Although this may suggest the possibility of subliminal messages, the effect of priming is so fleeting that it is difficult to detect outside laboratory conditions. Furthermore, the mere exposure effect —which requires consciousness of the stimuli— is far more effective than priming.

Modification

New information that falls within an individual's schema is easily remembered and incorporated into their worldview. However, when new information is perceived that does not fit a schema, many things can happen. The most common reaction is to simply ignore or quickly forget the new information. This can happen on a deep level— frequently an individual does not become conscious of or even perceive the new information. People may also interpret the new information in a way that minimizes how much they must change their schemata. For example, Bob thinks that chickens don't lay eggs. He then sees a chicken laying an egg.

Instead of changing the part of his schema that says 'chickens don't lay eggs', he is likely to adopt the belief that the animal in question that he has just seen laying an

egg is not a real chicken. This is an example of 'disconfirmation bias', the tendency to set higher standards for evidence that contradicts one's expectations.

However, when the new information cannot be ignored, existing schemata must be changed or new schemata must be created (accommodation).

Jean Piaget (1896-1980) was known best for his work with development of human knowledge. He believed knowledge was constructed on cognitive structures and he believed we developed our own cognitive structures through schema by accommodating and assimilating information. Accommodation is creating new schema that will fit better with the new environment or adjusting old schema. You should think of accommodation as change.

Accommodation could also be interpreted as putting restrictions on schema you have already had. Accommodation usually comes about when assimilation has failed. Assimilation is when you use current schema to understand the world around you. Piaget thought that schema would be applied to everyday life and therefore you would accommodate and assimilate information naturally.[19] For example, if this chicken has red feathers, Bob can form a new schemata that says 'chickens with red feathers can lay eggs'. This schemata will then be either changed or removed, in the future.

Assimilation is the reuse of schemata to fit the new information. An example would be, when an unfamiliar dog is seen, a person will probably just integrate it into their dog schema. However, if the dog behaves strangely, and in ways that doesn't seem dog-like, there will be accommodation as a new schema is formed for that particular dog. With Accommodation and Assimilation comes the idea of equilibrium. Piaget describes equilibrium as a state of cognition that is balanced.

When schema are capable of explaining what it sees and perceives. It moves development along in children and adults, Piaget did not think that development progressed steadily but actually in leaps and bounds. When information is new and cannot fit into existing schema this is called disequilibrium and this is an unpleasant state for the child’s development.

When disequilibrium happens, it means we are frustrated and we will try to restore the balance in our cognitive development by trying to overcome the new information through accommodation. If the new information is taken then assimilation of the new information will proceed until they find that they must make a new adjustment to it later down the road, but for now the child remains at

equilibrium again. The process of Equilibration is when you move from the equilibrium phase to the disequilibrium phase and back into equilibrium.

There are different kinds of schema that someone can experience. The first and most obvious one is self-schema; this schema contains information that we think about ourselves. It can sometimes influence, modify or distort what we remember or how we recall information. The next schema is person schema, which is the idea that we all have schema that includes judgments and traits that everyone possesses. Role schema is when we have ideas based on the jobs that other people have and social positions in the world. Event schema is what we associate with activities and events that other people perform.

8.2 Taxonomy de Bloom: **Bloom's taxonomy** is a way of distinguishing the fundamental questions within the education system. It is named after Benjamin Bloom, who chaired the committee of educators that devised the taxonomy. He also edited the first volume of the standard text, *Taxonomy of Educational Objectives: The Classification of Educational Goals*.

Bloom's taxonomy refers to a classification of the different objectives that educators set for students (learning objectives). It divides educational objectives into three "domains": cognitive, affective, and psychomotor (sometimes loosely described as "knowing/head", "feeling/heart" and "doing/hands" respectively). Within the domains, learning at the higher levels is dependent on having attained prerequisite knowledge and skills at lower levels. A goal of Bloom's taxonomy is to motivate educators to focus on all three domains, creating a more holistic form of education.

Bloom's taxonomy is considered to be a foundational and essential element within the education community. A mythology has grown around the taxonomy, possibly due to many people learning about the taxonomy through second hand information. Bloom himself considered the Handbook "one of the most widely cited yet least read books in American education"

Cognitive

Categories in the cognitive domain of the revised Bloom's taxonomy (Anderson et al. 2000)

Skills in the **cognitive domain** revolve around knowledge, comprehension, and critical thinking on a particular topic. Traditional education tends to emphasize the skills in this domain, particularly the lower-order objectives.

There are six levels in the taxonomy, moving through the lowest order processes to the highest:

Knowledge

Exhibit memory of learned materials by recalling facts, terms, basic concepts and answers

- Knowledge of specifics - terminology, specific facts
- Knowledge of ways and means of dealing with specifics - conventions, trends and sequences, classifications and categories, criteria, methodology
- Knowledge of the universals and abstractions in a field - principles and generalizations, theories and structures

Questions like: What are the health benefits of eating apples?

Comprehension

Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating the main ideas

- Translation
- Interpretation
- Extrapolation

Questions like: Compare the health benefits of eating apples vs. oranges.

Application

Using acquired knowledge. Solve problems in new situations by applying acquired knowledge, facts, techniques and rules in a different way

Questions like: Which kinds of apples are best for baking a pie, and why?

Analysis

Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations

- Analysis of elements
- Analysis of relationships

- Analysis of organizational principles

Questions like: List four ways of serving foods made with apples and explain which ones have the highest health benefits. Provide references to support your statements.

Synthesis

Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions

- Production of a unique communication
- Production of a plan, or proposed set of operations
- Derivation of a set of abstract relations

Questions like: Convert an "unhealthy" recipe for apple pie to a "healthy" recipe by replacing your choice of ingredients. Explain the health benefits of using the ingredients you chose vs. the original ones.

Evaluation

Present and defend opinions by making judgments about information, validity of ideas or quality of work based on a set of criteria

- Judgments in terms of internal evidence
- Judgments in terms of external criteria

Questions like: Do you feel that serving apple pie for an after school snack for children is healthy?

8.3 Taxonomy de Marzano: Marzano's New Taxonomy

Robert Marzano, respected educational researcher, has proposed what he calls A New Taxonomy of Educational Objectives (2000). Developed to respond to the shortcomings of the widely used Bloom's Taxonomy and the current environment of standards-based instruction, Marzano's model of thinking skills incorporates a wider range of factors that affect how learners think and provides a more research-based theory to help teachers improve their learners' thinking.

Marzano's New Taxonomy is made up of three systems and the Knowledge Domain, all of which are important for thinking and learning. The three systems are the Self-System, the Metacognitive System, and the Cognitive System. When faced with the option of starting a new task, the Self-System decides whether to continue the current behaviour or engage in the new activity; the Metacognitive

System sets goals and keeps track of how well they are being achieved; the Cognitive System processes all the necessary information, and the Knowledge Domain provides the content.

Knowledge Domain

Traditionally, the focus of most teaching and learning has been in the component of knowledge. Learners were assumed to need a significant amount of knowledge before they could think seriously about a subject. Unfortunately, in conventional classrooms, teaching rarely moved beyond the accumulation of knowledge, leaving learners with a mental file cabinet full of facts, most of which were quickly-forgotten after the final test.

Knowledge is a critical factor in thinking. Without sufficient information about the subject being learned, the other systems have very little to work with and are unable to engineer the learning process successfully. A high-powered automobile with all the latest technological features still needs some kind of fuel to make it fill its purpose. Knowledge is the fuel that powers the thinking process.

Marzano identifies three categories of knowledge: *information, mental procedures*, and *physical procedures*. Simply put, information is the "what" of knowledge and procedures are the "how-to."

Information

Information consists of organizing ideas, such as principles, generalizations, and details, such as vocabulary terms and facts. Principles and generalizations are important because they allow us to store more information with less effort by placing concepts into categories. For example, a person may never have heard of an *akbash*, but once someone knows that the animal is a dog, he knows quite a bit about it.

Mental Procedures

Mental procedures can range from complex processes, such as writing a research essay to simpler tasks such as tactics, algorithms, and single rules. Tactics, like reading a map, consist of a set of activities which do not need to be performed in any particular order. Algorithms, like computing long division, follow a strict order which does not vary by situation. Single rules, such as those covering capitalization, are applied individually to specific instances.

Physical Procedures

The degree to which physical procedures figure into learning varies greatly by subject / learning area. The physical requirements necessary for reading may consist of no more than left-to-right eye movement and the minimal coordination needed to turn a page. On the other hand, physical and vocational education require extensive and sophisticated physical processes, such as playing tennis or building a piece of furniture. Contributing factors to effective physical processing include strength, balance, manual dexterity, and overall speed of movement. Many of the activities which learners enjoy in their leisure time such as sports or electronic game-playing require refined physical procedures.