

THEORETICAL BASIS OF LOGIC THINKING CAPACITY IN TEACHING CHEMISTRY AT HIGH SCHOOL

Truong van Tan¹ and Huynh GiaBao²

¹Chemical team –Phuoc Binh High School, Binh Phuoc province, Vietnam

²Faculty of basic science – Tien Giang Medical College, Tien Giang province, Vietnam

ABSTRACT

The thinking abilities must be constantly trained to improve. The practice of thinking in general and logical thinking in particular must be started from the time a person can perceive. In order to train logical thinking, the people must have basic knowledge of logical science, first of all, logic of students through learning activities, scientific research and application to life in high school. Research on the theoretical basis of logical thinking capacity in teaching chemistry will contribute to improving the accuracy, uniformity, continuity, thoroughness, reasonableness of arguments, enhancing efficiency and belief in set goals.

Key Words: Competence, logical thinking, teaching chemistry.

1. INTRODUCTION

People want to survive and develop must think. Directed thinking directs all living activities. They always move with the development of people and society. However, the capacity and level of thinking depend a lot on objective and subjective conditions. In which the role of the subjective factor is particularly important.

The capacity and level of thinking must be constantly trained by people to be able to improve[1].The training of thinking in general and logical thinking in particular must be started from when people can perceive it. To train logical thinking, people must have basic knowledge of logical science. First of all, formal logic through learning activities, scientific research and application in life.

The basic task of logical thinking in teaching in general, and teaching chemistry in particular is to clarify the way to achieve the lesson goals by logical manipulation and precise reasoning methods. Logical knowledge helps people improve their thinking skills,It creates the habit of thinking "smarter", improves accuracy, consistency, continuity, thoroughness, validity of arguments, and enhances efficiency and confidence in the goal.

2. CONTENT

2.1. Thinking and logical thinking in teaching

2.1.1. Thinking concept

In practice, there are many unknown and unknown things. But in order to master the practice, people need to thoroughly understand those unknowns, and have to point out their nature and normative relationship. That process is called thought [2].

From a physiological perspective, Thinking is understood as an active form of the nervous

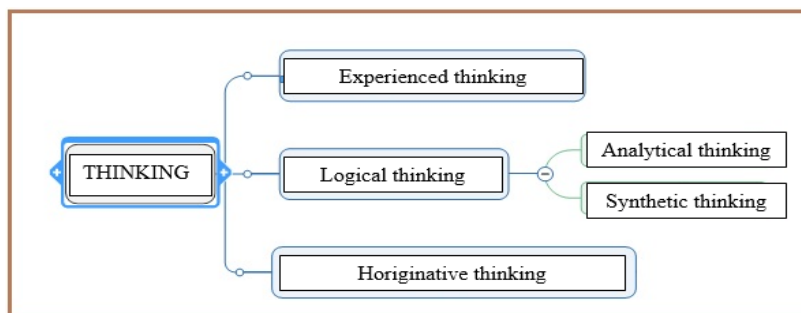
system manifested by creating connections between selected memorized elements and stimulating them to act to exercise awareness of the world around them, It is oriented for behavior in accordance with the environment. Thinking activities are synonymous with intellectual activity, martial brain activity. The goal of thinking is to find philosophies, reasoning, methodologies, methods, solutions in human activity situations.

Philosophy researches thinking in terms of cognitive theory. Thinking is formed in human cognitive and practical activities[3].Thinking and practical human activities have a close connection and dialectical relationship with each other.

According to Psychology, thinking thinking is a psychological phenomenon which is a higher level cognitive activity in humans. Thought is a psychological process that reflects intrinsic attributes, internal relationships and relations, and is normative of things and phenomena in objective reality[4].According to M.N. Sacacopp: *“Thinking is the indirect generalization of things and phenomena of reality in their signs, their general properties and nature. Thinking is also the creative perception of new, individual things and phenomena of reality on the basis of obtained general knowledge [5].*We agree with this view

2.1.2. Classification of thinking

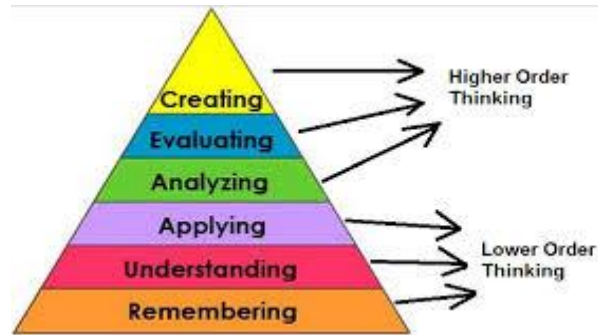
According to Nguyen CanhToan, thinking is divided into the following categories [6]: Logical thinking (based on the central and syllogistic laws), experienced thinking, horiginative thinking,...



Picture 1.Classification of thinking

Based on knowledge of Chemistry subject, we can train students to 10 types of thinking: (1) Independent thinking, (2) Logical thinking, (3) Abstract thinking, (4) Image thinking, (5) General thinking, (6) Multidirectional thinking, (7) Dialectical Thinking, (8) Critical Thinking, (9) Chemical Thinking, (10) ,Horiginative Thinking. Types of thinking are closely related. Practicing thinking that does not yield measurable results is like learning knowledge. Each time learning a correct way of thinking or discovering a wrong way of thinking. It is considered to have won an extra grain of sand to gradually create alluvium.

According to American educator Benjamin S. Bloom, the learner's Thinking is shown in the classification tower as below: Remember; Understand; Applying; Analyze; Evaluate; Create.



Picture 2.Bloom's Taxonomy

2.1.3. Logical thinking in teaching

2.1.3.1. Logical thinking

Logical thinking is a skill that is considered important for development from elementary school to university. According to A.V. Petrovski and L.B. Itenxon: "Thought replacing actions with real things with the application of concepts according to the rules of logic is called logical thinking" [7];[8].

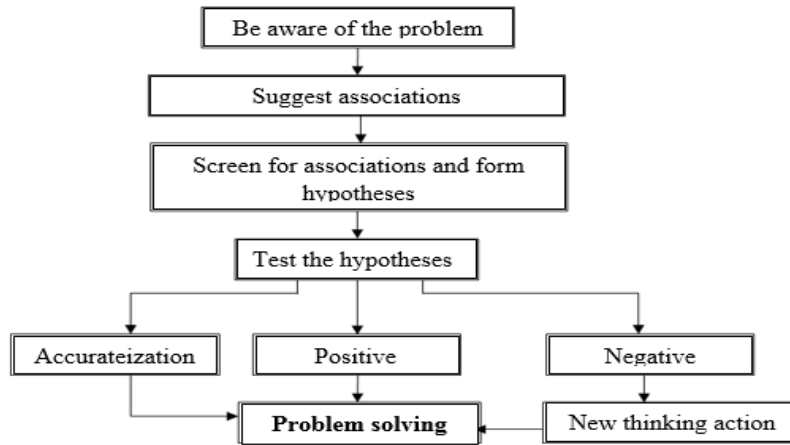
B. A. Ozahech's point of view: Logical thinking is the kind of thinking which requires the subject to draw consequences from given premises; divide separate cases and merge them; Predict specific results by theory, generalizing the results obtained. The author has highlighted Logical thinking characterized by taking consequences from axioms, dividing separate cases and combining them to be considered by the object; theoretical affirmation from a particular result or a generalization of the results obtained[9].

According to Vuong Tan Dat [10], Logical thinking is correct thinking, according to the rules, not making mistakes in arguments, discovering contradictions, that quality of thinking is of great value in any field of scientific and practical activities. Human logical thinking is not innate, it must be formed, trained, strengthened and developed regularly.

In the study, we introduce the following concept of logical thinking: "*Logical thinking is the process of perceiving the object, identifying related factors that are formed and connecting ideas, in order to find solutions and actions in accordance with the context of the object*"

2.1.3.2. Steps of logical thinking process

Based on thinking process of K.K. Plato, we define the stages (steps) of the logical thinking process as follows:



Picture 3.Steps of logical thinking process

2.1.3.3.Logical thinking operations

According to author Nguyen Thi Minh Loc [11]: Logical thinking is defined by the following concepts: Analysis, Synthesis, Comparison, Abstraction - Generalization and Systematization

Analysis: the division into constituent elements, signs and specific properties of the object. Starting from an analytical perspective, thinking activities go deeply into the attributes nature of each part from there to scientific hypotheses and conclusions. Thus, the realization of new things and phenomena becomes complete, complete and profound. Practice analytical skills is to form students the habit of learning objects and phenomena in depth.

Synthesis: Logical thinking activity uses the mind to unify components, combine parts, and factors have been analyzed for perception. In teaching, synthesis is to help students organize messy, discrete and diverse data and events that they have gathered through theoretical research and practical survey into things, manifestations. complete and unified processes. The result of the cognitive process is balanced and intimate activity, inseparable between analysis and synthesis.

Comparison: parallel analysis of two objects, two problems on the basis of similarities and differences between them, compare them with each other, carefully analyze each thing, discover them, use your mind to learn Comparable things, phenomena have some common in terms of external attributes or inner nature. comparison is an operation of logical thinking activity to help people find the similarities and differences when comparing one object with another based on a certain criterion, from which deep perception and highlight the subject.

Abstracting - generalizing:

+ Abstraction: using mind to remove elements, attributes, secondary, unnecessary relationships of things and phenomena and only retain the essential elements for thinking.

+ Generalization: using the mind to merge many different objects into a group, one type according to the most common attributes, relationships, and nature. In order to point out the essential signs, there must be analysis - a profound synthesis of things, generalized phenomena.

Systematization: is an intellectual manipulation that "arranges" all kinds of phenomena, objects into a system on the basis of common things. Systematization can be done in the form of

dividing certain individual objects into parts, certain classes, or in the form of arranging materials into certain systems. The condition for systematizing is that the object must be divisible, or a given set of individual elements must be closely linked. In teaching, systematization is the basis for forming high theoretical and generalized knowledge.

2.1.3.4. Logical thinking in chemistry teaching

The basic characteristic of logical thinking is rigor, systematic, inevitable and precise. Without one of these characteristics, there is no logical thinking.

According to the documents on Psychology and teaching methods of chemistry, the capacity of logical thinking is shown in the ability:

- + Know how to analyze things and phenomena through their characteristic signs.
- + Know how to change the viewing angle when considering an object or phenomenon.
- + Know how to find a short way to reach the necessary conclusion soon.
- + Know enough necessary conditions to reach the desired conclusion.
- + Know how to build the examples to remove some useless search domains.
- + Know how to return to the starting point to find a new way.

What is teaching logical thinking? Teaching logical thinking is teaching manipulations and forms of thinking:

(1) Teaching of observation and comparison: In teaching the chemistry of samples, natural objects, pictograms, symbolic objects, chemical experiments, ... is a source of knowledge for students. So we have to teach students how to observe and compare to gather information, process information and draw conclusions about new knowledge.

(2) Teaching inductive and deduction: From observations and practice comparison, let students know inductive.

(3) Teaching analysis and synthesis: Analysis associated with inference, synthesis associated with inductive. Analysis and synthesis alternate, orient for inference and induction.

(4) Teach how to build new exercises

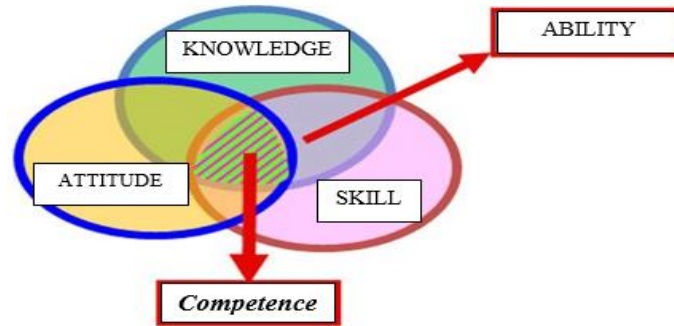
2.2. Competence

2.2.1. Capability concept

According to the psychologists' point of view: Energy is an individual's psychological property consistent with the specific requirements of a certain activity in order to ensure that the activity is highly effective.

Emphasizing on the performance of the capacity, FE Weinert said: "Competence is the ability to effectively and responsibly execute actions, solve tasks and problems in the professional fields, social or individual in different situations on the basis of applying knowledge, skills, techniques and experience as well as a willingness to act"[12].

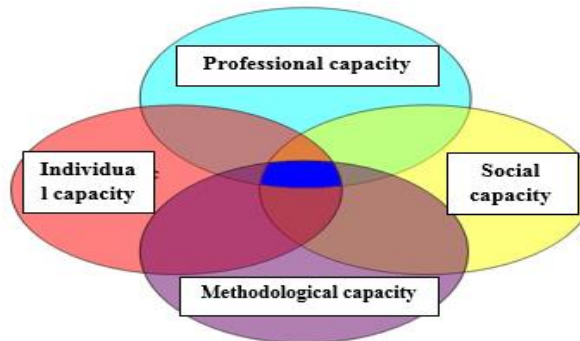
From the above points of view, we believe that: "*Competence is the ability to appropriately apply a system of knowledge, skills and attitudes to successfully perform a job in a certain context*".



Picture 4. Components of competency

2.2.2. The structure of the capacity

According to the structural approach, the general structure of Competence is described as a combination of four component competencies: Professional Competence, Methodological Competence, Social Competence and Individual Competency. The general structure of the competency is depicted by the diagram below:



Picture5.The structural components of the capacity

2.2.3. Rated capacity

LeenPil (CEGO, University of Leuven, Kingdom of Belgium) said: "Evaluation of competency is to evaluate knowledge, skills and attitudes of learners in a meaningful context"[7].

Competency assessment of general students is the process of using evaluation tools to analyze qualitatively and quantitatively of output products, through which teachers, students and related parties can all visualize. importance and accuracy of learners' achievements in the learning process ". Thus, in order to evaluate accurately, objectively and scientifically, it is necessary to establish a certain standard of competency for high school students.

It can be affirmed that the capacity assessment is the measurement of the ability to mobilize knowledge, skills and attitudes and apply them to complete a learning task according to a defined standard. In addition, the capacity assessment results also show the student's capacity development level in a specific learning period. There are some methods are commonly used to evaluate students' competency:(1) *Observation evaluation*; (2) *Evaluation through learning*

records; (3) Self-assessment; (4) Peer evaluation; (5) Evaluation through the test

Each evaluation tool allows us to collect information about students' capacity development in different aspects. Therefore, when evaluating students' competence, teachers need to use a combination of tools to make the assessment results more objective and reliable.

2.3.Logical thinking capacity

2.3.1. The concept of logical thinking capacity

Based on two bases, the concept of logical thinking of Plato, we give the concept of logical thinking capacity as: *“Logical thinking capacity is the ability of the subject to perceive the object, to determine the factors related to forming and connecting ideas, in order to find solutions and act in accordance with the context of the object”*.

2.3..2. Capacity structure for logical thinking

Based on the diagram of logical thinking stages of K.K.Platonop, we define the structure of logical thinking capacity including 5 component competencies: Identification of the object to study / learn; Ask yourself questions related to the object; Forming, connecting ideas; Find solutions and take action; Analyze, evaluate and draw from experience.

- (1) Identify the object that needs to be studied / investigated
- (2) Ask yourself questions related to the subject
- (3) Forming, connecting ideas
- (4) Find solutions and take action
- (5) Analyze, evaluate and draw from experience

3. CONCLUSION

Thus, logical thinking, like any other type of thinking, can be trained and developed. However, the effectiveness and level of developing logical thinking capacity depend on the choice of measures to suit each specific content of cognitive activities. In fact, training thinking skills is creating conditions to master a system of operations to clarify the information contained in research tasks and compare them with specific actions..

REFERENCES

1. E.N. Kabanova-Meller Mo (1998). The Formation of Measures for Intellectual Activity and Student Intellectual Development, Moscow, Education Publishing House
2. M. Alêcxep, V. Onhisuc, M. Crugliac, V. Zabotin, X. Vecxcle (1996). Pupil Thinking Development, Pedagogical University Publishing House, Hanoi
3. Vu Van Vien (2006). Principal of logic and the constituent parts of scientific thought, Philosophy, No. 12.
4. A.V.Petropxki (1992). Aging psychology and pedagogical psychology, Education Publishing House in Hanoi.
5. Le Van Dung (2001).Developing cognitive and thinking capacities for high school students through chemical exercises, Education science doctoral thesis, Hanoi University of Education.
6. Nguyen CanhToan (2010). Learn to catch up and beat, Labor Publishing House, Hanoi.
7. A.V.Petrovski, L.B. Itenxon (1992).Foundations of Age Psychology and Pedagogical

Psychology, volume 2, Education Publishing House, Hanoi.

8. A.V.Petropxki (1992). Age psychology and pedagogical psychology, Education Publishing House in Hanoi.

9. TOM. Korzruh, B.A Ozahecrh (1990).Mathematical Methods in School, Education Publishing House, Hanoi.

10. Vuong Tan Dat (2007). General logic, World Publishing House, Hanoi

11. Nguyen Thi M Loc (2019).Educational Psychology, National University Publishing House.

12. Weiner. F. E (2001).VergleichendeLeistungsmessung in Schulen -
eineumstritteneSelbstverstandlichkeit, In F. E. Weinert (ed), Leistungsmessung in Schulen,
Weinheim und Basejl: BeltzVerlag.