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Determining the structural framework and toolkit for assessing students' self-learning capacity through teaching chemistry at high schools in Vietnam

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Abstract
Self-learning in general and Self - learning capacity in particular is one of the essential activities that need to be formed and developed for students from high school to university. The Self - learning capacity structure plays an important role in teaching to train and develop this capacity for high school students and is meaningful for teachers in building a competency assessment scale. This article presents the process of building a Self - learning capacity structure and assessment toolkit for students through teaching chemistry in high schools.

Keywords: Assessment Toolkit, Capacity, Capacity Structure, Chemistry, Self-Learning, Student

1. Introduction
The issue of capacity and human resource development has been studied by many psychologists and educators around the world [1]. The overall general education program in Vietnam has been developed with 5 main qualities that need to be formed and developed in students. In terms of capacity, the program focuses on 10 core competencies required to live and work in a modern society, including self-directed and Self - learning skills [2]. The urgent problem posed in education today is to improve the quality of teaching and learning, and to innovate teaching methods. In order to achieve the basic goal of promoting positivity in learning, forming and developing common competencies required and specific competencies for students, focusing on creative thinking capacity, self-learning capacity, problem solving capacity in learning as well as in life. With the requirement of fundamental and comprehensive reform of education in the direction of capacity development, the application of active teaching methods has been paid attention and modern forms of teaching organization have maximized capacity development of each student according to their future career orientation.
Competency-based teaching in schools in general and high schools in particular forms in students the basic competencies to apply the knowledge and skills they have learned and trained to solve problems. urgent issues arising in life. Building a structure and toolkit to assess students' capacity in general and Self - learning capacity in particular is a very complicated activity because capacity itself is a hidden variable - a combination of architectural factors. knowledge, skills, attitudes, learning motivations, feelings, values, and ethics in contexts and practical projects to build learning problems. The article researches to build a toolkit to assess Self - learning capacity in teaching chemistry for students in high school through 4 components of competence and 10 criteria corresponding to the structure of Self - learning competence of students. students have been identified. If in the process of teaching chemistry, teachers can assess students' Self - learning capacity, it will have the effect of stimulating students' self-discipline, independence and determination in the learning process; contribute to improving the quality of teaching according to the competency approach.

2. Content
2.1 Self - learning and Self - learning capacity
2.1.1 Self - learning
Self - learning is an activity that occupies an important position in the teaching process. Currently, there are many different definitions of Self - learning.
According to the Vietnamese dictionary: "Self - learning means learning by yourself in a book, without a teacher" [3].
According to the Educator Dictionary: "Self - learning is the process of self-actualization of scientific knowledge and practice of practical skills" [4].
There have been many studies on TH from different angles. Some of the researchers' views on TH can be summarized as follows:

According to the concept of psychologists abroad, N.A. Rubakin believes that: "Self-learning is the process of acquiring knowledge, historical social experience in the practice of individual activities by establishing relationships to improve initial experience, comparing it with reflective models. reflecting the actual situation, turning human knowledge into the subject's own knowledge, experience, skills and techniques" [5].

From the point of view of educators, Nguyen Canh Toan said: "Self - learning is self-braining, thinking, and using intellectual abilities (observation, comparison, analysis, synthesis, etc.) and sometimes even muscles (when using tools), and their own qualities, motives, emotions, human outlook, worldview (such as honesty, objectivity, ambition, etc.) challenge, not afraid of difficulties, ...) to occupy a certain field of human knowledge, making that field their own" [6]. Thai Duy Tuyen asserts: "Self - learning is an independent activity that occupies knowledge, skills, and techniques, is brainstorming, thinking, and using intellectual abilities (observation, comparison, analysis, etc.) analysis, synthesis, etc.) together with motivational and emotional qualities to occupy the knowledge of a certain field of knowledge or the historical and social experiences of mankind, making it the property of the learners themselves." [7].

The above points of view show that the authors perceive Self - learning as a form of individual learning made by the learners' own efforts. In order to carry out this work, individuals must be self-conscious, active, and mobilize their intellectual capacities to perceive the problems posed by their own actions to achieve the goal. We realize that: Self - learning is an active self-discipline process of learners in order to carry out learning activities by themselves (Self - learning, self-expression, self-examination). The process may not or may not require the assistance of another person (arbitrator, organization, guidance). Learners always actively put themselves in learning tasks, process them to acquire knowledge, form and develop their own skills and techniques with the set goals.

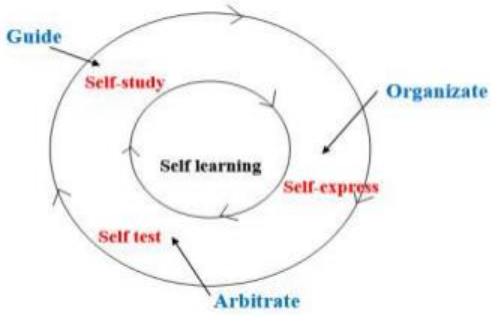

Fig 1: Self- learning diagram

According to Nguyen Canh Toan Self - learning has 3 forms [6]:

Table 1: Forms of Self - learning

S. No	Forms	Content
1	Self - learning without instruction	- Learners find materials to read, understand and apply knowledge by themselves. With this form, individuals tinker with their own interests and hobbies independently without books or teacher guidance. - This type of Self - learning must be based on a desire and passion to discover new knowledge and at the same time must have a wide and deep knowledge base. - At this level, learners without teachers, without books, but only with practice, can still effectively organize their activities.
2	Self - learning with indirect instruction	- There are teachers far away to guide learners with documents or other means of communication. - With this form, even though the teacher is far away, there are still relationships of information exchange between teachers and students by means of information exchange in the form of reflecting and answering questions, taking tests, taking tests, evaluate.
3	Self - learning with direct instruction	- There are documents and face-to-face with the teacher for a number of periods during the day, during the week, and then the instructor explains and then goes home. - In the process of learning in class, the teacher has the role of a supporting factor, a catalyst to promote and create conditions for students to own knowledge. - Students as the subject of the cognitive process: self-consciously, actively, passionately, creatively participate in the learning process.

The advantages for learners gradually increase from form 1 to form 3. Under form 1, learners face many difficulties, encounter where they don't understand, don't know who to ask, have to fumble around and spend a lot of time. But it helps people develop their independence. Form 3 seems to be the most favorable, but it easily causes dependence in learners because of the teacher's guidance too much.

Thus, students can use many different ways to acquire knowledge. In our research, we mainly focus on studying the activities of students outside the classroom under the guidance of teachers through teaching materials. The student's learning process through Self - learning and inquiry activities; self-actualization; self-assessment and adjustment and corresponding role of orientation; organization; teacher support, mentoring, and evaluation [1] as depicted in the following figure:

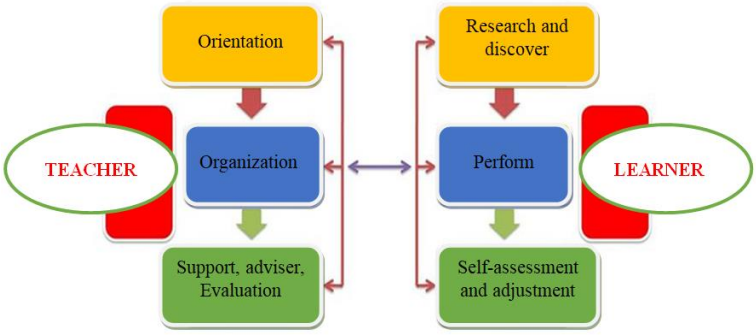

Fig 2: The role of teachers and students in Self - learning activities

2.1.2 Self - learning capacity

Self - learning capacity is an essential capacity that students of all levels need to have. With the concept of lifelong learning, "learning to learn forever" in a learning society, this is the key to entering the century of science and technology 4.0. For lifelong learning, it is necessary to have the capacity to Self - learning. Therefore, learning how to learn is the most important factor for students in high school. Research on Self - learning capacity, authors, Nguyen Canh Toan, Tran Ba Hoanh, etc. define: Self - learning capacity is not just a learner's capacity to actively acquire knowledge, have skills and attitudes that are suitable for students. learning but also the capacity to solve a specific task or learning situation (application of knowledge, skills); is a learning product of learners' experiences outside of school combined with experiences at school [8].

According to the general education program and 27 subject programs, the educational activities of the new education program have been promulgated in Vietnam [9, 10] which defines the core qualities and competencies that need to be developed for high school students. Self - learning capacity is identified as one of the three core common competencies that need to be formed and developed for students in all subjects and at all levels.

The concept of self-learning capacity is given by the authors as follows:

- Self - learning capacity is a capacity expressed in self-reliance, self-made, self-solving problem of an active subject.
- Self - learning capacity is the capacity to use intellectual abilities and sometimes even muscle capacity with motives, emotions, human outlook, worldview to occupy a certain area of knowledge. of humanity, making that field its own.

Through learning about the concepts of competence, Self - learning, and Self - learning capacity of domestic and foreign authors: Susan a turner [11] Tlobanova and Yu shunin [12], Thai Duy Tuyen [7], Nguyen Cong Khanh [13]. Within the scope of our thesis, we define the Self - learning capacity of high school students as the capacity of students to make a scientific and effective Self - learning plan. Self - learning plan has been made, self-assess the results achieved and adjust the Self - learning process with the support of the teacher.

2.2 Competency assessment test

Along with the innovation of teaching methods in the direction of comprehensive development of learners' competencies and qualities as determined by Resolution 29 (course xi), the education sector is gradually moving from assessment according to knowledge standards. and skills to capacity-based assessment means that teachers need to realize the hidden potential of learners, pay more attention to the progress and development of each individual's capacity in the learning process. Besides, capacity assessment is not only based on results but also focuses on the process of reaching results. Therefore, capacity assessment is a very important step in the teaching process, contributing to improving the quality of teaching [13].

From the perspective of developmental education, the evaluation of educational outcomes must aim at determining the progress of learners. Therefore, assessing student's capacity is understood as assessing the capacity to apply learned knowledge and skills to solve real-life problems. Competency assessment is the assessment of learners' progress so that they can improve their own learning. According to [1, 9, 11, 13], to assess students' capacity, we need to use the following methods and tools:

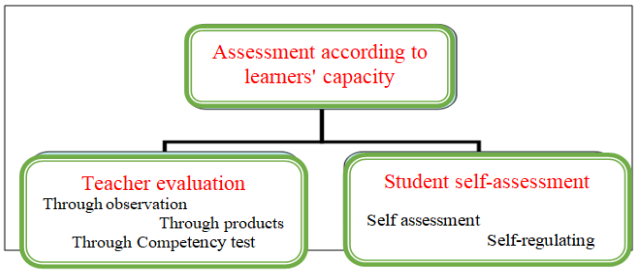

Fig 3: Evaluation methods

Thus, in assessing the capabilities of students and teachers, it is necessary to use the above assessment tools synchronously. When designing assessment tools (observational checklists, learning records, ...) Teachers need to clearly define the goals and manifestations of the competencies to be assessed, thereby determining the criteria and levels. clearly achieved.

2.3 Determining the structural framework of Self - learning capacity of high school students

2.3.1 The process of determining the structural framework of students' Self - learning capacity

The structure of students' Self - learning capacity plays an important and meaningful role for both teachers in building the assessment capacity scale. The structural framework of Self - learning capacity of high school students in dhhh is determined by a 5-step process according to the following figure and table:

Fig 4: The process of determining the Self - learning competency framework of students

Specifically:

Table 2: The process of determining the Self - learning competency framework of students

Step	Name of Step	Content
1	Determining the basis for building Self - learning capacity structure	- The overall education program [8] especially the Self - learning capacity of high school students - General education program in chemistry with components of chemical competence: chemical cognitive capacity, capacity to learn about the natural world under chemistry and the capacity to apply acquired knowledge and skills. learn - Published works on Self - learning capacity
2	Determining the component of competence and performance	- (1) Determine the learning objectives and content; (2) study planning; (3) implementation of the study plan; (4) evaluate, learn from and adjust - Describe 4 component competencies by 10 expressions (criteria), with 3 corresponding dollar levels
3	Seek expert advice	We send to the experts + Lecturer in the field of theory and teaching methods of the subject + Teachers of high schools
4	Test	At high school
5	Complete	Based on expert opinions and test results at Xuyen Moc high school, we continue to edit and perfect the framework of Self - learning competency structure.

2.3.2 Structural framework of Self - learning capacity of high school students

After adjustment, we have determined the structural framework of Self - learning capacity of high school students including 4 component competencies with 10 expressions (criteria):

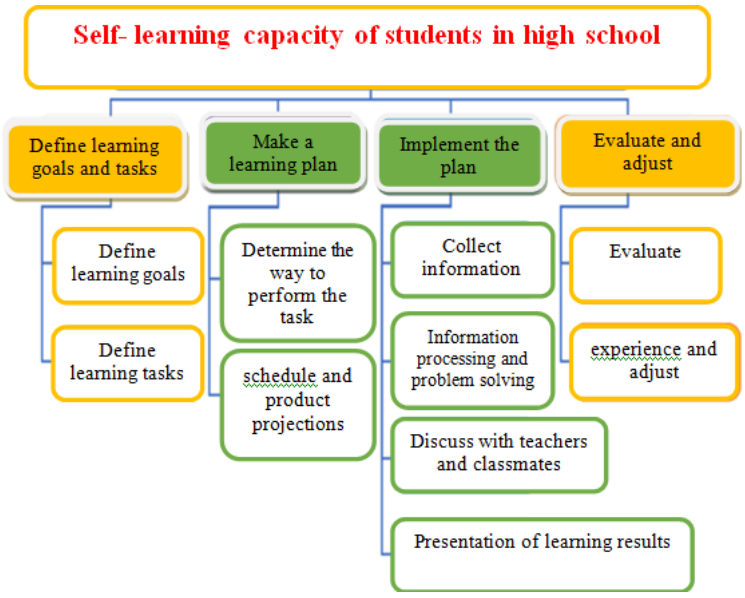

Fig 5: Structural framework of students' Self - learning capacity

The expression levels are detailed in the following table:

Table 3: Expression of Self - learning capacity of high school students

Elemental Capacity	Expression	Level		
		1	2	3
Define learning goals and content	Set learning goals and content	The objectives and content of the study are not set out properly and are not clearly detailed.	The goals and learning content are reasonable but not clear in detail.	Set clear and detailed learning objectives and content.
	Determine what is known to be relevant	Unclear and incomplete identification of relevant known facts	Clearly but incompletely identify relevant known facts	Clearly and fully identify relevant known facts
Make a study plan	Determine the means and methods of	Inadequate and inadequate identification of means and ways	Identify appropriate but incomplete means and ways of	Determine appropriate, adequate means and ways of

	performing the task	of performing Self - learning tasks.	performing Self - learning tasks.	performing Self - learning tasks.
	Make a timetable and project the results	Making a timetable that is unclear and unpredictable results of Self - learning	Make a clear and reasonable timetable but do not expect the results of Self - learning	Make a clear, reasonable and predictable timetable for Self - learning results
Make a study plan	Information collection	Collecting inaccurate and inappropriate information	Collecting accurate but not relevant information	Collect accurate and relevant information
	Information processing, problem solving	Incorrect processing, incomplete information collected	Accurate and scientific processing, but not enough information collected	Accurate, scientific and complete processing of collected information
	Collaborate with friends and teachers	Not actively cooperating effectively with teachers and classmates	Actively, often but not yet cooperating effectively with teachers and classmates	Actively, often effectively cooperate with teachers and classmates
	Show the results	Presentation of learning results is not logical and clear	Presenting learning results logically, unclear but incomplete	Presenting learning results logically, clearly and complete
Review, learn from experience and adjust	Evaluate	The assessment is not objective and not according to the criteria	Objective assessment but not proven criteria	Reviews are not objective and accurate
	Learn from experience and adjust	Point out the limitations, errors but not found find the right solution	Point out the limitations, errors and find a suitable but incomplete remedy	Point out the limitations, errors and find a suitable and complete remedy
Level 1. Students show Self - learning capacity but not often. Needs to be further developed Level 2. Students show Self - learning capacity quite often but not actively. It needs to be promoted Level 3. Students show regular and active Self - learning capacity. Needs to be maintained.				

2.4 Designing a Self - learning assessment toolkit for high school students

2.4.1 The basis for designing a Self - learning capacity assessment toolkit

In order to assess the capacity accurately and objectively, we base on the following bases to design the Self - learning capacity assessment toolkit:

- Based on regulations on qualities and competencies that need to be formed for high school students.
- Based on the standard of knowledge and skills in the chemistry.
- According to the literature on assessment in education.
- Structural framework of Self - learning capacity.

2.4.2 Design a toolkit to assess Self - learning capacity

In this thesis, in order to assess the Self - learning capacity for 12 high school students through teaching the chapters on alkali metals, alkaline earth metals, aluminum, we define a set of tools including: observation checklist; student rubric; aptitude test

2.4.2.1 Design an observation checklist

Purpose: through purposeful observation in the learning process, teachers assess the points of developing students' Self - learning capacity into practice.

Requirements: design an evaluation sheet of clear observational criteria suitable for the audience; adhere to the criteria of Self - learning capacity in the teaching process.

Design process:

Step 1: determine the objective, scope, time and object of observation and evaluation

Step 2: Identify reviewers.

Step 3: develop observation criteria and the level of achievement for each criterion.

Step 4: complete the criteria and the appropriate level of evaluation.

Step 5: determine how the evaluation data will be processed.

The evaluation form for students' Self - learning capacity for teachers through observation in teaching high school education is designed as follows:

Table 4: Self - learning assessment form for teachers

1. Day month Year……
2. School …….class……
3. Student's first and last name…….. tested times……..
4. Name and address of teacher: …… ……..

S. No	Criteria for students' Self - learning capacity	Point		
		(1)	(2)	(3)
1	Set learning goals and content			
2	Determine what is known to be relevant			
3	Determine the means and methods of performing the task			
4	Make a timetable and project the results			
5	Information collection			
6	Information processing, problem solving			
7	Collaborate with friends and teachers			
8	Show the results			
9	Evaluate			
10	Learn from experience and adjust			
Total score				
Level 3 is 3 points, level 2 is 2 points, level 1 is 1 point				

Table 5: Summary sheet of assessment results in a class

1. High school: .....
2. Class: .....

S. No	Student's first and last name	Criteria of students' Self - learning capacity										Total score
		1	2	3	4	5	6	7	8	9	10	
1												
2												
……												
Total points observed by the teacher												

Teachers rely on the above sheet to evaluate the corresponding performance level for each group of students.

The teacher calculates an observation score for each performance of each student or the average of all students based on the proposed 3-level scale of performance. From there, the Self - learning capacity of each student or the whole class can be assessed. If the teacher observed score is close to 1, further development is needed. If the observation point is close to level 2, it should be promoted. If the observation point is close to level 3, it should be maintained.

2.4.2.2 Student rubric design

- **Purpose:** students can self-assess their Self - learning capacity in practice with the level achieved in the learning process.
- **Requirements:** The assessment form should have clear criteria, closely follow the structure of Self - learning capacity in practice of students in the learning process.

We have designed student rubrics to collect information to assess students' Self - learning capacity:

Table 6: Student's rubric on the development of Self - learning capacity

1. School: .....
.....
2. Grade: .....Student's name.....

Please mark (x) in the corresponding box to show the level of achievement of your/your group's Self - learning capacity during class time.

S. No	Criteria for students' Self - learning capacity	Self-assessment		
		(1)	(2)	(3)
1	Set learning goals and content			
2	Determine what is known to be relevant			
3	Determine the means and methods of performing the task			
4	Make a timetable and project the results			
5	Information collection			
6	Information processing, problem solving			
7	Collaborate with friends and teachers			
8	Show the results			
9	Evaluate			
10	Learn from experience and adjust			
Total score				

2.4.2.3 Test design

Purpose: The test to assess students' Self - learning capacity helps clarify some criteria of Self - learning capacity. Through the test results, teachers will assess the level of knowledge and criteria in the Self - learning capacity of students.

Requirement: the questions used to assess students' Self - learning capacity must be in the form of multiple-choice tests according to the division of 4 levels.

Design process:

To design a test to assess the Self - learning capacity of high school students, teachers need to follow the following process:

Step 1: determine the goal and time of the assessment.

Step 2: determine the criteria to be evaluated, methods and conditions for performing the test.

Step 3: make up the test matrix, the questions to show, the content of the criteria to be evaluated.

Table 7: Matrix of tests

Content	Awareness level				Total
	Know	Understanding	Manipulate	High usage	
	Content	Content	Content	Content	
	Number of sentences	Number of sentences	Number of sentences	Number of sentences	
	Content	Content	Content	Content	
	Number of sentences	Number of sentences	Number of sentences	Number of sentences	
	Content	Content	Content	Content	
	Number of sentences	Number of sentences	Number of sentences	Number of sentences	
	Content	Content	Content	Content	
	Number of sentences	Number of sentences	Number of sentences	Number of sentences	
Total Total score	Total number of sentences 5.0	Total number of sentences 3.0	Total number of sentences 1.0	Total number of sentences 1.0	40 10

Step 4: Design questions, guide solutions, answer solutions in many ways.

Step 5: Experiment, discuss with colleagues and get expert opinion.

Step 6: Edit and complete.

3. Conclusion

Teaching in the capacity-based approach forms in students the basic abilities to apply the knowledge and skills that have been learned and trained to solve urgent problems. Assessment is the process of collecting information about students' learning outcomes according to training regulations. Thereby the teacher can evaluate the teaching process. On the basis of the theory of Self - learning capacity and Self - learning capacity assessment, we believe that in order to be able to evaluate students' Self - learning capacity, teachers need to collect evidences of students that clearly show the criteria set out in the curriculum. described in the self-learning capacity structure. Accurate and objective Self - learning assessment will have the effect of stimulating students to be more self-disciplined, independent and determined in the learning process.

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