Evaluate the Effectiveness of Teaching Physics through Teaching Knowledge about the Motion of the Thrown Object

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Abstract *Objectives of the study:* Evaluate the effectiveness of lectures designed and apply teaching methods for Grade 10 Physics. *Research Methods:* We conducted research with 81 students (Grade 10). Tools used include: lesson plans teach knowledge about the movement of the thrown object and are taught over a 2-week period. We first design the scientific progression diagram for the teaching activity, and the next is a process for specific teaching about the motion of the thrown object. To evaluate the research results, we use a carefully designed Rubric to evaluate the physics teaching process in the way that I propose. *Research results:* I find that students are excited about this teaching method, they are interested in examining knowledge, applying knowledge to solving situations in life, narrowing the gap between theory and real life, and increase students' motivation and flexibility in problem solving.

Keywords Teaching Physics, The Motion of Thrown Objects, Physics Experiment

1. Introduction

Physics studies the most fundamental forms of movement of matter [1], [2], [4]. Physics involves many

different phenomena in the natural world that is what happens in space and time that humans perceive directly by the senses. Phenomena are the outward manifestations of a certain thing. The phenomenon is very diverse and complex. In perception, man does not stop at only phenomena but must come to realize the nature of things. The essence is the synthesis of all the aspects, the relationships, relatively stable inside things regulating the movement and development of that thing [9], [10].

Concepts are formed in the process of understanding the aspects of the phenomenon. New concepts are born and used as tools for thinking, learning new aspects of phenomena, things that we cannot understand, describe, or cannot explain by old concepts. In other words, a new concept emerged due to the need to resolve a contradiction between existing understanding and the unknown, and also the result of that conflict resolution [2], [3], [9]. Building a concept means that we have studied each aspect, each property of things and phenomenon.

The task of science in general and physics in particular is not only to study specific aspects, but to study phenomena, things in their movement, in their dependencies, to find the objective, common relationship binding them together, that is to find laws, regulations [2], [4].

On the path of physical perception, scientists always try to generalize further, in order to be able to explain the underlying causes of phenomena in the increasingly

broader fields; hence the theory of physics is born. Physics theory is a system of ideas, rules, laws of physics used to explain, predict, and apply physical phenomena based on the recognition of one (or several) fundamental thesis (considered as axiom) [2], [3].

In teaching physics, the basic knowledge such as: physical phenomenon, physical quantity, the laws of physics, the rules of physics, physics theory, etc will form the main content of physics [2], [3], [4].

2. Literature Reviews

Knowledge of physical phenomena is often formed in the process of examining and analyzing observational results of actual phenomena and experimenting with physics. Therefore, when forming knowledge is a certain physical phenomenon, first of all, teachers need to create conditions to ensure students have clear and accurate symbols of that phenomenon. Then on the basis of these symbols of students, with questions of reasonable orientation, the teacher helps students to detect the general signs, the nature of phenomena and check that cognitive results through observation and experiment [3], [4], [5], [17], [18]. That is, when studying knowledge of a physical phenomenon, students must define that phenomenon (based on the nature sign of the phenomenon) and determine the condition for phenomenon performance. For example, when teaching knowledge of total reflection phenomenon, teachers give orientation so that students can define the total reflection phenomenon, find out the conditions of the total reflection phenomenon; Or when studying the phenomenon of free fall, the first thing is that students must define what is free falling? Then go on to investigate the condition of an object known to be free-falling.

The concept of physics is the basic form of the cognitive result, formed as a result of thinking activities, especially the two closely linked processes of generalization and abstraction. Concepts reflect properties of things as well as the relationships between those properties [2], [7], [11], [12] [13]. In the concept of physics, there is a concept of special importance, which is the concept of a physical quantity such as the concepts of velocity, acceleration, force, heat, amperage, etc. Each physical quantity has two characteristics: a qualitative feature and a quantitative feature. The qualitative feature is to express a certain property of things or phenomena. Quantitative characteristics tell us how big or small, strong or weak of that property, and how to determine and measure this magnitude and smallness. Concepts of physical quantity are characterized by a unity between qualitative and quantitative features, in which the quantitative feature emerges due to the need for precise measurement [14],

[18]. The way to form the concept of a physical quantity includes the following typical stages

- Stage 1: Discover qualitative characteristics
- Stage 2: Show the quantitative characteristics of the concept
- Stage 3: Define the physical quantity
- Stage 4: Determine the unit of measure
- Stage 5: Apply concepts into practice.

However, the way to form the concepts of all physical quantities goes through the sequence of the above stages. There are quantities occurring simultaneously with the laws of physics denoting the relationship between new and old quantities. Regarding some physical quantities, after quantitative features have been determined, the qualitative characteristics of the concept have been found (e.g. the concept of momentum).

The laws of physics are universal, objective relationships between the properties of objects, processes and states described through physical quantities, existing under defined conditions and manifesting when these conditions are relatively stable and repeatable present. The laws of physics describe things and phenomena in nature that can be perceived by humans. They can be discovered by man through natural observation or experiment, can also be deduced from general laws known through logical or mathematical reasoning. The laws of physics are constructed by man to reflect the laws of objective reality [2], [4], [6], [8]. Therefore, in physics research as well as in teaching physics, the path of forming the laws of physics also follows the path of forming the laws of physics.

In teaching, the knowledge of laws (rules) of physics often reflects quantitative relationships between specified physical quantities under certain conditions. Establishing a specific relationship (reflected in the content of the law) can be done in different ways depending on the content characteristics of the particular knowledge and depending on the level of development of students at different levels of education, etc. [15], [16]. Laws can be formed based on conducting experiments, observing, measuring, analyzing experimental results, stating the content of the laws that need to be studied; or in another case, the law may be built from a hypothetical model drawing logical consequences, this consequence is tested experimentally and if the experimental result matches the hypothesis then the hypothesis is a definite law of physics; or there is also the case that the laws of physics are formed from a known general theoretical proposition that we predict to be related to the phenomenon in question, thereby making the prediction by theoretical inference about the relationship between the quantities in the phenomenon, then do experiments to check if that prediction is consistent with reality, if so, that prediction is a law [2], [3], [4].

2.1. The Process of Teaching the Knowledge about the Motion of the Thrown Object

2.1.1. Diagram of the Scientific Process of Building Knowledge

B1. A problem arises to be solved: Using an interactive on-screen experiment depicting consecutive positions of a ball thrown by an athlete into the basket (Assume that air resistance is negligible.).

B2. Addressing the problem: Assume that air resistance is negligible. What is the ball's trajectory? What factors determine the long range and high flight range of the ball? In the motion of the thrown object, what relation describes the relationship between the coordinates, velocity, acceleration and motion time of the object?

B3. Problem solving

B3.1. Predict the solution

The trajectory of motion is a curve in the plane and the object is only affected by gravity. If analyzing the movement of the object in the two directions, Ox and Oy are perpendicular to each other; Oy vertically upwards, the motion of the object in the direction of Ox will be the linear motion and the movement of the object in the direction of Oy is the motion linearity varies evenly with $-g$ acceleration. Applying knowledge of these two types of motion, we will find out the relation describing the dependence of x and y on time, and then write out the orbital equation of the object (the relation expressing the relationship between y and x); thereby finding out the motion trajectory of the object. Simultaneously, from the expressions of x , y according to t , developing the argument, we will find the formula to calculate the speed, acceleration, high and far range of the object.

B3.2. Implement the solution

Select the coordinate plane xOy whose O coincides with the point of throwing the object, the time origin is the time of throwing: In the Ox direction: $x_0 = 0$; $v_{ox} = v_0 \cos \alpha$; $a_x = 0$; $v_x = v_0 \cos \alpha$; $x = (v_0 \cos \alpha)t$. (1) In the Oy direction $y_0 = 0$; $v_{oy} = v_0 \sin \alpha$; $a_y = -g$; $v_y = v_0 \sin \alpha - gt$; $y = (v_0 \sin \alpha)t - gt^2/2$ (2) $\rightarrow$ orbital equation $y = -gx^2/(2v_0^2 \cos^2 \alpha) + (\tan \alpha)x \rightarrow$ orbit is a parabolic line. The velocity of an object: $v = \sqrt{v_x^2 + v_y^2} \rightarrow v = \sqrt{g^2 t^2 - 2v_0 \sin \alpha \cdot gt + v_0^2}$; $\tan \beta = \frac{v_y}{v_x}$. The acceleration of the object: $a = a_y = -g$ When the object reaches the maximum height $v_y = 0 \rightarrow t_1 = \frac{v_0 \sin \alpha}{g}$. Replace t_1 into (2), we have the altitude of the object is $H = \frac{v_0^2 \sin^2 \alpha}{2g}$ When the object reaches its maximum distance, $y = 0 \rightarrow t_2 = \frac{2v_0 \sin \alpha}{g}$. Replace t_2 into (1) we have the maximum distance $L = \frac{v_0^2 \sin 2\alpha}{g}$ [20]

B3.3. Test results from theoretical inference

Determine the content to be tested by experiment

Consider the case of a movement of the object being thrown. Select the coordinate system xOy with Ox parallel to the ground in the positive direction of throwing, Oy perpendicular to Ox in the positive direction from bottom to top, the two axes of the positive direction are the direction of motion in two directions, the origin degree at starting position considering motion, time origin $t_0 = 0$ when object with coordinate $x_0 = 0, y_0 = 0$, throw speed v_0 , then

- + The graph of y regarding x is a parabolic line with the coordinate equation: $y = -gx^2/(2v_0^2 \cos^2 \alpha) + (\tan \alpha)x$ [21]. The orbit is a parabol line
- + The graph of x regarding t is a line slanting an angle through the origin with equal slope ($v_0 \cos \alpha$)
- + The graph of y regarding t is a parabolic line through the origin with the coefficient $A = -g/2$; $B = v_0 \sin \alpha$
- + Formula for calculating maximum height: $H = \frac{v_0^2 \sin^2 \alpha}{2g}$ [21]
- + Formula for long-range calculation: $L = \frac{v_0^2 \sin 2\alpha}{g}$ [21]

Design test plan: Use interactive experiment on screen

Do the experiment:

- + Select the appropriate coordinate system: determine the position of the point substance at times t evenly spaced; collect x and y data in terms of t (with Δt small enough) in proportion to the standard embedded in the video; measure the angle of throw α ; determine the velocity v_0
- + Draw x according to t , use function fit graph of standard function, determine the value of the coefficient of angle, compare with the value of ($v_0 \cos \alpha$) deduce content drawn from theoretical inference is correct
- + Draw y according to t , use function fit graph of standard function, determine the values of the coefficients A, B (A and B are the two coefficients in the standard function $y = Ax^2 + Bx$), compare the value of A with value ($-g/2$), compare the value of B with the value of ($v_0 \sin \alpha$), then determine that the content drawn from theoretical inference is correct.
- + Draw y according to x , use function fit graph of standard function, determine coefficients A, B (A and B are two coefficients in normal function $y = Ax^2 + Bx$), compare value of A with value ($-g/2v_0^2 \cos^2 \alpha$), compare the value of B with that of ($\tan \alpha$), and then determine that the content drawn from theoretical inference is correct.
- + Measure L , compare with the value calculated from the formula $L = \frac{v_0^2 \sin 2\alpha}{g}$,
- + Measure H , compare with the value calculated

from the formula $H = \frac{v_0^2 \sin^2 \alpha}{2g}$

* Note: Take $g = 9,8 \text{ m/s}^2$ (or take the value from the experiment in the previous lesson on freefall motion)

B4. Conclude

- The coordinates of the object: $x = (v_0 \cos \alpha)t$; $y = (v_0 \sin \alpha)t - gt^2/2$;
- The orbit is the parabola, the orbital equation is: $y = -gx^2/2v_0^2 \cos 2\alpha + (\tan \alpha)x$
- The speed of the object: $v_x = v_0 \cos \alpha$; $v_y = v_0 \sin \alpha - gt$; $v = \sqrt{g^2 t^2 - 2v_0 \sin \alpha \cdot gt + v_0^2}$
- The acceleration of object: $a_x = 0$; $a_y = -g$; $a = a_y = -g$
- The high range of object is: $H = \frac{v_0^2 \sin^2 \alpha}{2g}$; the long range $L = \frac{v_0^2 \sin 2\alpha}{g}$

- The high and long flight range of the object depends on the angle of the throw and the speed of the throw
- B5. Apply
- Study the motion of an object thrown horizontally at height h
- Test the formula for total velocity v , the value of acceleration a_x, a_y
- Explain the phenomena: throwing javelin, throwing dumbbells, shooting stones ... in reality
- Do related exercises

2.1.2. Specific teaching process

Activity 1: Learn the rules of motion, the relationships between the physical quantities of the oblique motion

Activity 1.1. Addressing the problem

Activities of the teacher	Activities of students
- Raising a problem to be solved: Using an interactive on-screen experiment depicting consecutive positions of a ball thrown by an athlete into the basket. Assume that air resistance is negligible. - Raising a new research problem: What is the trajectory of the ball? What factors determine the long range and high flight range of the ball? In the motion of the thrown object, what relation describes the relationship between the coordinates, velocity, acceleration and motion time of the object? - Asking students to repeat the problem to be solved	- Implementing the request of the teacher - Recalling the research problem

Activity 1.2: Infer solutions to solve problems by theoretical reasoning and performing speculative solutions

Activities of the teacher	Activities of students
* Ask a question: - Essential Question: + Instruction: To know the trajectory of the oblique motion, it is necessary to know the y-coordinate equation for the x of the motion. To do this, it is necessary to analyze the motion in two directions: Ox parallel to the ground and Oy perpendicular to the ground. + Question: What old knowledge can be used to establish the relationship between coordinates $(x), (y)$, velocity $(v_x), (v_y)$ and time (t) in two directions to build orbital equation, the formula for the velocity (v) , the altitude (H) and the range (L) of the oblique motion? - Specific question: + In the two directions Ox and Oy , what is the feature of movement of things? + In each analyzed motion, apply the formulas to determine the coordinates and velocity of motion in the two directions? + From the relationships, interpret to find the time-independent relation between x and y ? → Draw conclusions about the line shape of the skewers' trajectory? + How is the speed of the object at any moment t determined? (Assume that air resistance is negligible) + When the object reaches its maximum height, what is the velocity of the object in the Oy direction? From there, how high is the flight range (H) ? + When the object reaches its maximum range, what is the coordinate of the object in the Oy direction? How far is the maximum range (L) ?	* Guess the solution: The trajectory of motion is a curve in the plane, the object only affected by gravity. If analyzing the movement of the object in the two directions Ox and Oy are perpendicular to each other, the motion of the object in the direction of Ox will be the linear motion, and the motion of the object in the direction Oy is straight movement varies evenly with acceleration $(-g)$. Applying knowledge of these two types of motion, we will write the relation describing the dependence of x and y on time, and then write the orbital equation of the object (the relation expressing the relationship between y and x); thereby deducing the trajectory of the motion. At the same time, from the expressions of x, y according to t , developing the argument, we will find the formula to calculate the speed, acceleration, high flight range, and far flight of objects. * Implement solution: Select the coordinate plane xOy whose O coincides with the point of throwing the object, the time origin is the time of throwing: In the Ox direction: $x_0 = 0$; $v_{0x} = v_0 \cos \alpha$; $a_x = 0$; $v_x = v_0 \cos \alpha$; $x = (v_0 \cos \alpha)t$ (1) In the Oy direction $y_0 = 0$; $v_{0y} = v_0 \sin \alpha$; $a_y = -g$; $v_y = v_0 \sin \alpha - gt$; $y = (v_0 \sin \alpha)t - \frac{gt^2}{2}$ (2) → orbital equation $y = -gx^2/(2v_0^2 \cos 2\alpha) + (\tan \alpha)x$ → orbit is a parabolic line. The velocity of an object: $v = \sqrt{v_x^2 + v_y^2} \rightarrow v = \sqrt{g^2 t^2 - 2v_0 \sin \alpha \cdot gt + v_0^2}$; $\tan \beta = \frac{v_y}{v_x}$. The acceleration of the object: $a = a_y = -g$ When the object reaches the maximum height $v_y = 0 \rightarrow t_1 = \frac{v_0 \sin \alpha}{g}$. Replace t_1 into (2), we have the altitude of the object is $H = \frac{v_0^2 \sin^2 \alpha}{2g}$ When the object reaches its maximum distance, $= 0 \rightarrow t_2 = \frac{2v_0 \sin \alpha}{g}$. Replace t_2 into (1) we have the maximum distance $L = \frac{v_0^2 \sin 2\alpha}{g}$

Activity 1.3: Determine the content to be tested by experiment

Activities of the teacher	Activities of students
<p>- Ask the question: Assume that air resistance is negligible. What do we need to test for a skew-throwing motion?</p> <p>+ Hints: Basing on relationships between the specific quantities for a skew-throwing motion to find content that can be tested by the experiment.</p> <p>+ Specific suggestions: It is possible to rely on the relationships of coordinates, velocity, long range, high flight range ... to find content that can be tested by the experiment.</p>	<p>- Answer the question: Consider the case of a movement of the object being thrown. Select the coordinate system xOy with Ox parallel to the ground in the positive direction of throwing, Oy perpendicular to Ox in the positive direction from bottom to top, the two axes of the positive direction are the direction of motion in two directions, the origin degree at starting position considering motion, time origin $t_0 = 0$ when object with coordinate $x_0 = 0, y_0 = 0$, throw speed v_0, then</p> <p>+ The graph of y regarding x is a parabolic line with the coordinate equation: $y = -gx^2/(2v_0^2\cos^2\alpha) + (\tan\alpha)x$. The orbit is a parabol line</p> <p>+ The graph of x regarding t is a line slanting an angle through the origin with equal slope $(v_0\cos\alpha)$</p> <p>+ The graph of y regarding t is a parabolic line through the origin with the coefficient $A = -g/2; B = v_0\sin\alpha$</p> <p>+ Formula for calculating maximum height: $H = \frac{v_0^2\sin^2\alpha}{2g}$</p> <p>+ Formula for long-range calculation: $L = \frac{v_0^2\sin 2\alpha}{g}$</p> <p>....</p>

Activity 1.4: Proposing a plan for experiment and testing (group work)

Activities of the teacher	Activities of students	Type of experiment used
<p>- Raising questions to propose experimental plans: How to test the above contents from the experiment?</p> <p>+ Suggested general question: In order to test the above contents through experiments, which quantities should be measured? Use what tools to measure? How do we measure those quantities?</p> <p>+ Specific question: Which quantities appear in the content to be tested? To test the relationships between them by experiment it is necessary to measure them, so how to measure them?</p> <p>- Is there any experiment you already know to do the above experimental options?</p> <p>- Assigning students to conduct the experiment according to the proposed plan: Divide the class into 04 groups to do interactive experiments on the screen with different testing contents.</p> <p>- Observing and help students in the process of doing experiments</p>	<p>- Proposing the experiment: Using an interactive experiment on the screen, recording a motion of a skewer with a standard ruler, using a two-dimensional ruler tool to determine the position of the object at evenly spaced times, using angle measuring tool to determine throw angle, using ruler to determine displacement Δs in a small amount of time Δt to determine throw speed, collect data and process test data of the above contents.</p> <p>- Taking mission</p> <p>- Groups assigned tasks: assemble tools, conduct experiments, collect data, etc.</p>	<p>Use the interactive on-screen experiment to test some of the content:</p> <p>- Graph (x, y):</p> <p>- Graph (y, t):</p> <p>- Graph (x, t):</p>

Activity 1.5: Discuss experiment results and draw conclusions

Activities of the teacher	Activities of students
<ul style="list-style-type: none"> - Ask the group representative to report on the experiment results - Summarize, draw conclusions - Ask students to solve the task assigned initially (exercise about an athlete performing a javelin) 	<ul style="list-style-type: none"> - Representatives of groups reporting experimental results: Comparing the experimental results with the results drawn from theoretical inferences, showed that - The coordinates of the object: $x = (v_0 \cos \alpha)t$; $y = (v_0 \sin \alpha)t - gt^2/2$; - The orbit is the parabola, the orbital equation is: $y = -gx^2/2v_0^2 \cos 2\alpha + (t \tan \alpha)x$ - The speed of the object: $v_x = v_0 \cos \alpha$; $v_y = v_0 \sin \alpha - gt$; $v = \sqrt{g^2 t^2 - 2v_0 \sin \alpha \cdot gt + v_0^2}$ - Acceleration of objects: $a_x = 0$; $a_y = -g$; $a = a_y = -g$ - The object's high flying range is: $H = \frac{v_0^2 \sin^2 \alpha}{2g}$; Long range $L = \frac{v_0^2 \sin 2\alpha}{g}$ [20], [21]. → The high and long range of an object depends on the angle of the throw and the speed at which the object is to be thrown. - Complete task

Activity 2: Study the motion of an object thrown horizontally at height h

Activities of the teacher	Activities of students
<ul style="list-style-type: none"> - Assigning tasks: Determining the coordinate equation, the formula for calculating the velocity, the formula for calculating the long range of the horizontal throw movement. - Nhận xét, kết luận: Trong chuyển động của vật bị ném ngang tại độ cao h so với mặt đất: $y = - (gx^2)/(2v_0^2) + h$; $v = \sqrt{g^2 t^2 + v_0^2}$; $L = v_0 \sqrt{2h/g}$ 	<ul style="list-style-type: none"> - Accept the task, perform the task Select the coordinate plane xOy, origin O at the ground, the time origin is the moment of the throw, Ox is parallel to the ground, Oy is perpendicular to the positive ground upwards and passes through the throw point, then according to the Ox direction: $x_0 = 0$; $v_{0x} = v_0$; $a_x = 0$; $v_x = v_0$; $x = v_0 t$ (3) according to the Oy direction: $y_0 = 0$; $v_{0y} = 0$; $a_y = -g$; $v_y = -gt$; $y = h - \frac{gt^2}{2}$ (4) Deduce $y = -gx^2/(2v_0^2) + h \rightarrow$ Orbital is half a Parabola The speed of the object: $v = \sqrt{v_x^2 + v_y^2} \rightarrow v = \sqrt{g^2 t^2 + v_0^2}$, $\tan \beta = \frac{v_y}{v_x}$ When the object reaches the maximum distance, $y=0 \rightarrow t = \sqrt{2h/g}$. Replace t into (3) we have the maximum range $L = v_0 \sqrt{2h/g}$ - Group representatives present the results on the board

Activity 3: Assign the task to do at home

Activities of the teacher	Activities of students	Type of experiment used
<ul style="list-style-type: none"> - Do exercises in the textbook and workbook - Test the formulas for calculating high flight range, long flight by experiment, the variation of the speed magnitude of the object according to t - Explain the phenomena: throwing javelins, throwing dumbbells, shooting stones ... in reality - Do related exercises 	<ul style="list-style-type: none"> - Listen and accept tasks 	<ul style="list-style-type: none"> - Using real experiments, interactive experiments on the screen

3. Methods

In order to promote the primacy of lecture in Physics teaching and learning, an experimental study was conducted with 81 grade 10 students at Luong Ngoc Quyen High School. The motion of the thrown object was selected as an experimental research for the following reasons: (1) surveyed subject was grade 10 students with knowledge of theory and practice from a basic level or higher, thus, it is easy to conduct learning activities related to knowledge and practical experience;

(2) The author of the article is also a teacher and has participated in teaching Physics in a number of high schools; she/he can self-evaluate his/her teaching methods through research on their own teaching activities.

Material Used

The study was conducted at Luong Ngoc Quyen High School with 81 students in two classes.

The study time is discussed by the research team with

the teachers of Physics and administrators, in order not to affect the general learning activities of the school and the class. We are suggested to do it in 2 weeks and in the physics lessons that are scheduled from the beginning of the school year.

Research teams and teachers taught students about topics for two weeks respectively. The tools used are as follows:

1. Setting a work plan includes a physics lesson plan with the subject (The Motion of Thrown Objects) taught over a 2-week period. Students have been prompted by teachers to explore and exchange these topics before doing research.
2. Giving a tutorial on the process of designing situations teaching physics "The motion of the thrown object"
3. A Rubric is meticulously designed to assess students' cognitive processes. Criteria self-assessment guides are used differently in different assessment stages.

After the teaching activity is over, all students fill out a self-assessment of their past performance. This self-assessment consists of 10 questions, of which 8 closed questions address students' perception of scale-based lesson content (1 = Good; 2 = fair; 3 = average; 4 = weak), and 2 open-ended questions about students' problems and suggestions for improving Physics teaching activities.

Self-assessment questionnaire

This questionnaire is intended to study the self-assessment of students participating in experimental research. Students circle their answers on questions 1-8 following the instructions below and state their opinion for questions 9-10.

(1) = Good; (2) = fair; (3) = average; (4) = weak

Questionnaire

Content	Level			
	(1)	(2)	(3)	(4)
1. I have the opportunity to delve deeply into the content I have learned				
2. I can improve my ability to build knowledge and creativity by presenting practical examples in diverse and attractive forms.				
3. I can improve self-regulation and have better control over learning during the learning process.				
4. I can develop autonomy in learning through goal setting, planning and organizing learning activities.				
5. I can develop collaboration skills, teamwork skills and responsibilities during the learning process.				
6. I can improve my problem solving and critical thinking ability in the learning process				
7. I find the teaching method that teachers use to help students be inspired, confident and effective in learning.				
8. I want this teaching method to be replicated in many other subjects.				

State your opinions on the following questions:

9. What difficulties do you face in the learning process?

10. Do you have any suggestions for experimental teaching methods to be better?

4. Results

Survey results show

Content	Good		Fair		Average		Weak	
	Quantity	Percent %	Quantity	Percent %	Quantity	Percent %	Quantity	Percent %
(1)	43	53.09	29	35.80	9	11.11	0	0.00
(2)	31	38.27	37	45.68	9	11.11	4	4.94
(3)	38	46.91	30	37.04	13	16.05	0	0.00
(4)	38	46.91	27	33.33	12	14.81	4	4.94
(5)	44	54.32	26	32.10	8	9.88	3	3.70
(6)	33	40.74	28	34.57	13	16.05	7	8.64
(7)	37	45.68	27	33.33	13	16.05	4	4.94
(8)	35	43.21	31	38.27	10	12.35	5	6.17

Based on the above statistics, I see that students are aware of the appropriateness of the teaching method that I propose, specifically:

For 8 closed questions:

- For content (1) students chose good and fair with high rates of 63.09% and 35.80% respectively, while the average rating was only 11.11% and weak at 0%.
- For content (2), I find that the number of students rated fair level is quite higher than the good level when mentioning to construct knowledge and create ability by presenting practical examples. However, in this content, 9/81 students (11.11%) said that they could only meet at an average level; especially, there are 4/81 students (4.94%) saying that they are weak in this content.
- For content (3) and (4), the rating is good, fair and average in the two relatively similar contents. Only in content (4), there are 4 students (4.94%) that they are still weak in this content.
- Similar to contents (5), (6), (7) and (8), based on the data sheet, I noticed that the majority of students had a good and quite high rating; for the average there are still between 8 and 13 students; and the level of weakness remains, however this rate is low, only from 3.70% to 8.64%.

For 2 open-ended questions:

- Question 9, summing up, I found that most students find it difficult to convert between mathematical expressions into computer physics experiments, however, after a period of time being instructed by teachers, and students have time to try it out, they no longer find it difficult.
- Question 10, many students said that they find the teacher's teaching method is reasonable; they study and build knowledge for themselves well. Only a few students suggest to add physics experiments to the teaching process of Physics; students want teachers to have a form of assessment for their self-study when previous problems suggested by the teacher.

5. Findings

- *From the above research results, I have solved the following problems:*
- Propose a way to form knowledge about a motive movement of quality points, helping students' positive cognitive activities, self-reliance and creativity.
- Contribute positively to training students' critical thinking and creative thinking. On the basis of using knowledge and experience, students will consider, evaluate and see the problem that needs to be solved.

- Develop the ability to explore and consider under many different angles. While problem solving and discovery, students will mobilize their personal knowledge and abilities to cooperate, exchange, and discuss with their peers to find the best problem solving.
- Through problem solving, learners are perceived knowledge, skills and methods of authentication (in which problem solving has become a teaching goal, concretized as a goal of development in problem solving capacity- a capacity at the forefront for people to adapt to the development of society)

However, in the teaching method that I propose in the research, there are certain limitations, specifically:

- It requires teachers to invest a lot of time and efforts. Teachers must have good pedagogical ability to think, to create many problem-solving situations and guide to explore to detect and solve problems.
- The organization of teaching takes a long time. Moreover, only certain knowledge and operating methods, which are cleverly selected and well-grounded, will become the object of this proposed teaching method.

6. Conclusions

The teaching and learning process aims to organize positive, self-reliant and creative cognitive activities for students, making an important contribution to the implementation of the goal of training people with sufficient knowledge, ability, intelligence and personality qualities to meet the requirements of society in the new period in Vietnam. Therefore, teaching in the direction of developing the positivity, self-reliance and creativity of students is one of the development strategies of education and training in Vietnam today.

Moreover, from the task of teaching physics in high schools developing scientific thinking in students actively, self-reliant in participating in the process of building and applying knowledge, creativity to solve problems in learning and practice later [17], at the same time, from the specificity of the Physics subject in high school "Physics in high school is mainly experimental, in which there is a smooth combination between observation, experiment and theoretical reasoning in order to achieve the unity between theory and practice"[30], I found that applying the teaching method of problem discovery and problem solving in Physics follows experimental theoretical reasoning way have a great effect in developing students' positive cognitive activities, self-reliance and creativity in teaching physics. Research results have proven that students are excited, interested in exploring knowledge, applying knowledge to solving situations in life, narrowing the

gap between theory and life, increasing motivation and students' flexibility in problem solving.

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