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The Importance Of Independent Learning In Teaching Physics

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Abstract: This article discusses the advantages and disadvantages of independent learning compared to traditional instruction, its main forms, as well as the criteria for organizing and assessing independent study in physics using learner-oriented formats that foster creative thinking and creativity.

Keywords: Independent learning, criteria, creativity, flexibility, experiment, project, mini-project, idea, analysis, conclusion.

Introduction: Physics is an experimental science that teaches learners to understand, observe, analyze, and apply natural phenomena and processes in practice. In modern education, developing learners' skills of independent learning is of great importance.

Independent learning is the process in which a learner increases their own level of knowledge and practical activity through independent inquiry: observing phenomena and processes, analyzing them, applying them in practice, and being able to evaluate the results. In this process, the learner studies independently, without the direct supervision of the teacher, but on the basis of the teacher's instructions and recommendations. Independent learning is a process of working on oneself, belonging not to the teacher but to the learner. From this it follows that independent learning develops the learner's activity, responsibility, curiosity, and creativity.

The purpose of organizing independent learning in physics is to develop learners' logical thinking, to arouse interest in scientific and practical investigation in the analysis of physical phenomena and processes, to form skills of generalizing, analyzing, and drawing conclusions from results, and to develop the ability to apply the acquired theoretical and practical knowledge in real practice.

Its tasks are: to independently master basic concepts, laws and regularities; to be able to apply theoretical knowledge to practical problems, that is, to transfer it into practice; to independently organize and carry out experimental work; and to form skills of independently analyzing, comparing, and generalizing completed work.

The importance of independent learning is that it broadens the learner's level of knowledge and ensures it is retained in memory for a long time. The learner becomes a person who thinks independently and responsibly, analyzes, draws conclusions, and can make decisions. Their creative and research abilities are developed. They learn to allocate time correctly and are taught to plan the state of practical processes.

Advantages of independent learning compared to traditional instruction:

– It develops the skill of self-development – the learner searches for information independently, their research ability is formed and they analyze information, which in turn strengthens independent thinking, creativity and innovativeness. The learner or student learns to manage themselves.

– Flexibility and freedom – everyone studies according to their own abilities and interests.

– It develops critical and logical thinking – the learner or student analyzes the collected information and learns to identify what is useful. This process enhances thinking and the ability to make independent decisions.

– Active use of modern technologies – through the internet, online courses, electronic libraries and educational platforms, learners find and

use a wider range of information, which increases their digital literacy.

– The drive for creativity and applying learned information in practice is strengthened – in the process of independent work, the learner develops new ideas and insights and conducts scientific inquiry independently of the teacher.

– Independent learning teaches and forms in the learner a sense of responsibility and self-control – in the learning process, the learner is personally responsible for the result, which prepares them to make independent decisions in life.

– It is oriented toward personal interests and needs – each learner chooses a topic based on their own capabilities and level of knowledge, which ensures an individual approach.

Disadvantages of independent learning compared to traditional instruction:

– **Lack of teacher guidance and control** – the learner may not be able to monitor their own knowledge independently. The teacher's opinion and support are necessary to correct mistakes and provide direction.

– **Problems of motivation and discipline** – in independent learning, maintaining regularity and consistency can become an obstacle.

– **Reduction of communication and social learning** – group work, exchange of ideas, and discussions as forms of social learning are limited. This slows down the development of critical thinking and communicative skills.

– **Limited opportunities for practical experience** – for experimental work and technical activities, the teacher's supervision, analysis and conclusions are necessary.

– **Passivity of the assessment and analysis system** – a learner studying independently may not be able to objectively evaluate their own level of knowledge. In the traditional system, there are tests and assessment results provided by the teacher.

Sequence of organizing independent learning:

– **Planning** – the learner, based on their interests and abilities, voluntarily selects the form and topic of independent learning and defines the goals and tasks.

– **Searching for information (sources)** – collecting information on the chosen topic from literature, textbooks, manuals, methodological guides and recommendations, scientific articles, and internet resources.

– **Analysis (observation and idea formation)** – comparing and generalizing the obtained theoretical and practical information.

– **Practical application** – developing a project plan, conducting experiments, performing calculations, and drawing conclusions.

– **Submitting a report** – presenting the results (in written form, as a presentation, or visually, etc.).

– **Self-assessment** – analytically reviewing the results and drawing conclusions from errors and shortcomings.

The forms of organizing independent learning in physics can be grouped as follows:

1. Individual assignments: essays, problem solving, experiments – in these forms each learner works on a personal task. They are designed to develop independent work, analysis, and creative thinking.

– Essay (referat) – a written analysis of a topic, a specific law, or the work of a scientist.

– Problem solving – independently solving practical problems based on the laws and rules of physical phenomena and processes.

– Experimental work – conducting an experiment based on a chosen topic.

– Mini-project – analyzing technical devices from real life through the laws of physics and drawing conclusions, implementing one's own idea in practice.

– Preparing a conspectus – systematizing the main formulas and laws on the basis of a textbook or video.

2. Group-based: projects, seminars, presentations – the learner studies a physical process or phenomenon and presents the results in the form of a presentation or report. In this form, students work in small groups, which develops cooperation, communication, and analytical skills.

– Group project work – for example, a project on the topic "Energy consumption in technical devices" or "Equilibrium of forces in construction."

– Seminar–discussion – for example, a debate on the topic "Newton's laws in modern technology."

– Carrying out experimental work as a team – comparing results, drawing conclusions, and implementing a general idea based on opinions and reflections.

– Preparing a presentation – explaining a mechanical phenomenon using graphs, tables, and diagrams.

3. Research–creative: scientific work, model construction, innovative project – in these forms the learner masters elements of scientific research.

– Research work – for example, "Testing the law of free fall using simple instruments."

– Scientific article or essay – writing based on physical phenomena or processes.

– Model construction or creation of an experimental device – a model that demonstrates phenomena or processes based on physical laws and regularities.

– Innovative project – applying physical laws and regularities in practice (robotics, energy-saving systems).

4. Innovative and creatively integrative: creation, development, innovation – this is one of the most important stages today, where the learner creates something new on the basis of their own idea. Here, based on physical laws and regularities, learners design physical models or devices, create computer simulations, use interactive methods (crosswords, clusters, mind maps), prepare multimedia presentations, and defend their projects.

5. Integrated forms (physics with mathematics, informatics, technology, etc.) – in these forms physics is connected with other subjects.

– Integration with mathematics – representing equations of motion in graphical form.

– Integration with informatics – analyzing mechanical processes through computer modelling.

– Integration with technology and engineering – analyzing the motion or force distribution in machine parts.

Since physics is an experimental science, the assignments given to learners have important practical significance and should lead them toward creativity and innovation.

Based on the above, we consider it appropriate to choose the following forms of independent learning when organizing self-study in physics. These are:

Individual assignments: problem solving, experiment (mini-project).

Group-based: project, seminar.

Research–creative: model construction.

Innovative project: applying physical laws in practice (robotics, energy-saving systems).

Below, we provide some examples of topics for using the experimental form in independent learning.

Below we present examples of experiments (mini-projects) from some sections of physics that can be practically carried out at home. These help develop creative thinking in learners. The sequence of experiments (projects) is organized in the following structure: aim, equipment used, procedure, analysis and conclusion.

Experiment 1. Testing the law of conservation of energy (Spring)

Aim: To test the law of conservation of energy using the extension of a spring.

Equipment used: spring, small weights, measuring device, graph notebook.

Procedure:

1. Hang successive weights on the spring. Measure the amount of extension.
2. Calculate the potential energy: $\mathrm{E} = \frac{1}{2}\mathrm{kx}^2$ Draw a graph to show its compliance with Hooke's law.
3. Compare the experimental and theoretical values and provide an explanation.

Analysis and conclusion

Experiment 2. Determining the specific heat capacity of water

Aim: To determine the specific heat capacity of water experimentally.

Equipment used: thermometer, electric kettle or heater, container (metal or glass), water, stopwatch.

Procedure:

1. Pour a known mass of water (200 g) into the container. Measure the initial temperature.
2. Switch on the heater and record the new temperature after 2–3 minutes.
1. The energy consumed: $\mathrm{Q} = \mathrm{P} \cdot \mathrm{t}$
2. Calculate the specific heat capacity: $\mathrm{c} = \frac{\mathrm{Q}}{\mathrm{m}(\mathrm{T}_2 - \mathrm{T}_1)}$

Experiment 3. Constructing an electromagnet and studying the field strength

Aim: To study the formation of a magnetic field when current flows through a conductor and to investigate its strength. Equipment used: iron nail, copper wire (1–2 m), battery (3V–6V), paper clips or small iron pieces, switch (or simply connecting/disconnecting the wire).

Procedure:

1. Wind the copper wire around the nail 30–50 times and connect the ends to the battery.
2. Bring the electromagnet close to the iron pieces and observe the result.

3. Change the number of turns (20, 30, 50 turns) and compare the results.
4. Increase the voltage (by connecting an additional battery) and observe the changes.

Analysis and conclusion.

Experiment 4. Investigating light refraction
Aim: To experimentally determine the angle of refraction when light passes from one medium to another. Equipment used: glass prism or glass plate, laser pointer or LED light source, protractor, white paper, pencil.

Procedure:

1. Draw the outline of the glass plate on the white paper.
2. Direct the light beam at the glass at a known angle.
3. Mark the incident and refracted rays on the paper.
4. Measure the angles using the protractor.
5. Repeat for several different angles.
6. Analysis and conclusion.

Experiment 5. Model of spectral lines (hydrogen spectrum)
Aim: To demonstrate that spectral lines are formed as a result of transitions between atomic energy levels.

3. Equipment used: cardboard, transparent strings, coloured paper (red, blue, green), ruler.

Procedure:

1. Draw a vertical diagram of the energy levels on the cardboard.
2. Paste coloured strips between the transitions (using the colours of the Balmer series).
3. Arrange the spectral lines from left to right.

Analysis and conclusion.

Criteria for assessing the results of independent learning

In order to determine the effectiveness of independent learning, clear assessment criteria are developed. The main criteria are given below:

- Quality of knowledge – the degree to which physical laws and regularities are correctly understood and applied in practice.
- Practical skills – correct performance of experimental, calculation or modelling tasks.
- Level of individuality in completing the assignment – the extent to which the learner is able to complete tasks and experiments independently.
- Level of analysis, conclusion-drawing and creative approach.
    - Analysis and drawing conclusions – the ability to analyze studied phenomena and processes on the basis of physical laws and regularities and to explain them scientifically.
    - Creativity – the ability to propose a new idea, model or approach.
- Accuracy and logical coherence – clear and understandable written or oral presentation of the results of the work.
- Timely submission and initiative.
- Correct use of information sources.

Assessment can be carried out using a 100-point or 5-point system, for example: “86–100 points – Excellent”, “71–85 points – Good”, “56–70 points – Satisfactory”, “0–55 points – Unsatisfactory”.

The teacher’s role in organizing independent learning.

In organizing independent learning, the teacher is not a controller but a guide. The teacher performs the following tasks: encourages the learner to conduct research, directs them toward independent thinking, and presents differentiated tasks taking into account the learner’s level of preparedness. The teacher provides recommendations and methodological guidance, monitors and analyses the learners’ work, and, when necessary, offers distance support through digital technologies (PhET, Google Classroom, LearningApps, etc.).

Thus, the teacher is the facilitator of independent learning, while the learner is its main active participant.

CONCLUSION

In conclusion, it can be said that independent learning is one of the most important components of the modern education system. It increases the learner’s activity, creativity (innovative potential), and their capacity for scientific and practical self-development. For every teacher and learner, organizing independent learning correctly is a guarantee of increasing the effectiveness of lifelong education.

Proper organization of independent learning in physics develops learners’ skills of working on themselves, inquiry and problem-solving, applying theoretical knowledge in practice, and forming creative thinking. Clearly defining assessment criteria, in turn, makes it possible to evaluate learners in a fair, transparent, and motivating way.

REFERENCES

1. Abduraxmonov Q., Hamidov V. Fizika fanidan virtual laboratoriya ishlarini bajarish uchun metodik qo’llanma. TATU, –Toshkent, 2007. – 69 b.
2. Abduqodirov A.A., Pardayev A.X. Ta’lim jarayonini

texnologiyalashtirish nazariyasi va metodologiyasi. –Toshkent, Fan va texnologiya. 2012. – 102 b.

3. Sheraliev Sadullo Suyunboevich. Factors of organizing and performing physics laboratory lessons in education. Web of scientist: international scientific research journal. ISSN: 2776-0979, Volume 4, Issue 4, April., 2023 -P.279-283. https://wos.academiascience.org/index.php/wos/article/view/3703/3555
4. Sa'dullo Sheraliev, Dj. Irkabaev, D. Sulaymanova and Y. Abduganieva. Electronic learning complex in physics and introduction of the section "Vibrations and Waves". Cite as: AIP Conference Proceedings 2432, 030090 (2022); https://doi.org/10.1063/5.0091221. Published Online: 16 June 2022. https://aip.scitation.org/doi/abs/10.1063/5.0091221
5. Sheraliyev S.S. Tebranish va to'lqinlarni o'rganishda zamonaviy axborot texnologiyalarini joriy etishning ilmiy-uslubiy va amaliy jihatlari. Monografiya. "Fan va texnologiya", –Toshkent, 2017. – 132 bet.
6. Sheraliyev S.S va boshqalar. "Elektromagnit tebranishlar va to'lqinlar bo'yicha virtual laboratoriya ishlari" elektron o'quv majmuasi. O'zbekiston respublikasi intellektual mulk agentligi. Guvohnoma. № DGU 03604. –Toshkent, 16.03.2016.
7. Sheraliyev Sa'dullo Suyunboyevich. The importance of modern nformation. Technologies in teaching physics. Current Issue Vol. 34 No. 2 (2024): World scientific research journal|WSRJ| Published: 2024-12-20 -P.48-50.
8. https://scientific-jl.org/index.php/wsrj. https://scientific-jl.org/wsrj/article/view/6614
9. Sheraliyev S.S., Abdullayev B.I., Qo'chqorov Sh.X. Talabalarning mustaqil ta'limini tashkil etish va nazorat qilish. Inter education & Global study. Ilmiy-nazariy va metodik jurnal 2025-yil,3-son - Buxoro, 2025 -B 419-426.