Activation of cognitive activity of future engineers during graphical training

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Abstract
The article shows that graphic problems are powerful source and stimulating agent motivating the students for active cognitive and creative work during study of graphical disciplines; methods and techniques promoting the effectiveness of graphical preparation of future engineers, which are directed to both personality development and his further professional establishment, are suggested.
Key words: ENGINEER, GRAPHICAL PREPARATION, GRAPHICAL PROBLEMS, COGNITIVE ACTIVITY, GRAPHICAL DISCIPLINES, DESIGN-AND-ENGINEERING COMPETENCE.

Social changes and processes occurring in Ukraine require training of engineers, who are able modeling and designing geometric forms, performing engineering development of pieces, which require deep, graphic and speciality training. So, V. Morkun and Z.Bakum mark that fundamental training is one of the directions of professional training of mining engineer. The main task of this training lies in formation of design-and-engineering competence and all-round

development of the student as a personality, who strives to further benefication and growth of educational potential [3, p. 105]. That is why under current conditions future specialist should be able to fulfill research-and-development and inventor's work; to acquire knowledge using own resources for creative activity; to know the approaches of engineering creativity, which will provide the possibility for graduate to correspond new market needs.

Readiness of engineers for work in modern manufacturing environment and growth of their professionality depends on the quality of digestion of theoretical and practical material. This requires study arrangement, during which the students strive to active mental efforts and search of simple and rational algorithms of tasks solution during graphic training. A. Esaulov marks that the usage of tasks during study is a potent incitement of mental activity of students focused on the realized and independent acquiring of knowledge [2, c. 49]. So graphic disciples should be ensured with tasks, which will motivate future engineers to cognitive activity and application of acquired knowledge during further study at university.

That is why graphic training should be fulfilled in respect with needs of future professional activity and should provide activation of cognitive and creative activity. This is emphasized by L. Anisimova, who considers that graphic tasks promote cognitive activity, during solution various hypotheses should be made, which are the elements of creative activity during the process of solution search [1, p. 150-151]. This will contribute deep digestion of educational material, which requires application of various methods and techniques, which contribute the development of creative and independent abilities and motivation for study of graphical disciplines.

It should be marked that activation of cognitive activity of future engineers is an important problem of modern pedagogics, solution of this problem directed to the increase of effectiveness of graphical training. Scientists, who research the problem of formation of educational-cognitive activity (N. Bibik, S. Velichko, L. Vygotskiy, P. Gal'perin, A. Leont'ev, S. Rubinshteyn, A. Savchenko, V. Sukhomlinskiy, N. Talyzina, G. Shchukina) mark that activation of cognitive activity requires application of such methods and study approaches, which effectively influence on the increase of cognitive interest, purposefulness, responsibility during study of graphical disciplines for formation of skills necessary for future professional activity.

In coarse of cognitive activity there engrained the qualities necessary for future specialist: activity, creativeness, independence. That is why for successful graphical training, active study methods, which promote interest stimulation of students to study of graphical disciplines and move the students to discussions during collective solution of study-cognitive tasks, which positively influences not only on the development of the power to analysis and design, but on the listening art and elaborate hypotheses of other colleagues, are the most effective.

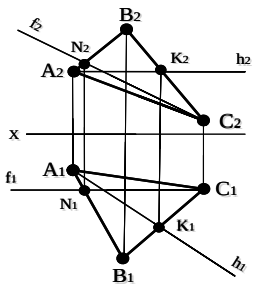
N. Chopova emphasizes that future engineers while solving graphical tasks should be confronted with difficulties but it should be according to student’s possibilities. Choosing the tasks, teacher analyses procedures of cognitive activity necessary for task solution, considers students’ knowledge, models in his mind's eye some situations with which future engineers may meet while working [5, p. 106]. Thereafter such active teaching methods should be applied during study of graphical disciplines: problem (problem teaching, partially searching, investigatory), discussions, directed on the development of personality and his further professional establishment.

Besides that during implementation of active methods of study it is necessary to observe the algorithm of gradual complication of the tasks taking into account individual abilities of students. Correctly chosen graphical tasks will allow to repeat, systematize and reinforce theoretical material, which will allow to activate cognitive activity during study of graphical disciplines. During development of such tasks, psychological and didactical conditions should be considered:

- Realization of the aim of proposed graphical task;
- Connection of tasks with theoretical topics of the course;
- Sequence and systemacity of suggested tasks (when previous task helps to prepare for data digestion);
- Variety of tasks according to the content and complexity;
- Gradual complication of suggested tasks in respect with individual possibilities of students;
- Determination of optimal quantity of tasks enough for digestion and consolidation of certain topic.

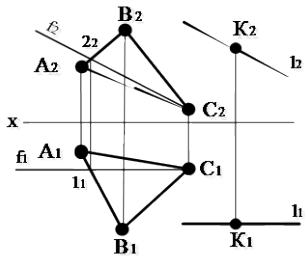
In the context of the problem, which is being developed, it should be marked that for activation

of cognitive activity, explanation of process regularity of solution of basic graphical tasks, which will allow to follow theoretical practical and technical stages of certain topics of discipline of graphic cycle, is important [4]. Students' realization of the aim and sequence of suggested task solution promotes the development of logical reasoning, spatial representation, professional skills, without which further design-and-engineering activity is impossible (fig. 1).

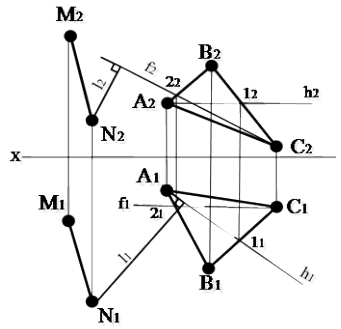


1. Through point A of the area G(ΔABC) to draw the horizontal h, and through the point C – frontal f.
Horizontal of the plane is the right line, which is parallel to projection plane P1. Front projection of the horizontal h2 is always parallel to x axis. To build horizontal projection of this horizontal let us build projection K1 of the point K and draw a right line through projections A1 and K1. The built line AK is a horizontal of the plane: the right line belongs to the plane, as it goes through two points, which belong to it, and parallel to projecting plane P1.

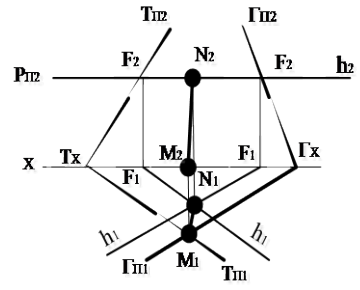
2. Through the point K to draw a line, parallel to the plane T(ΔABC)



In the triangle plane T (ΔABC) let us draw a frontal with projections $C_1 1_1$ and $C_2 2_2$. Projections of desired right line l are drawn through the projections K_2 and K_1 points are parallel to frontal: $l_2 // C_2 2_2$; $l_1 // C_1 2_1$.



3. Through the right line MN to draw a plane, perpendicular to the defined T (ΔABC). Desired plane should pass through the right line MN that is why it is determined by the line MN and perpendicular to the triangle plane. To draw this perpendicular in the ABC plane there were drawn frontal f and horizontal h. Through the point N we will draw a line $l \perp ABC$ ($l_2 \perp f_2$, $l_1 \perp h_1$). Formed by two lines MN□ the plane is perpendicular to set plane ABC.



4. To find intersection line of the planes T and Γ.
One of the points of intersection line of the plane is known from graphical condition of the task (on the crossing of horizontal plane traces). To find the second point of the intersection line let us introduce intermediary horizontal cutting plane P (Рп2 // П1). This plane crosses separate planes T and Γ on the levels h1 и h1. At their intersection we will get horizontal projection N1 of the point, which is general for these planes. So these planes are crossed along the line MN.

Figure 1. Tasks for activation of cognitive activity of future engineers during graphical training

Thereafter future engineers are assured with the tasks, which promote the development of their creative abilities, activate their mental activity, informative search (analysis, hypothesizing, abstracting, comparison, synthesis, etc). During didactical processing of graphical task students should have clear formulation of condition (worded description, graphical representation or clearly evident space model), they should be able to map back practical and theoretical material, develop purposefulness, responsibility and persistence in end of purpose. Teacher fulfills coordinating function, agreed upon with laws,

methods and principals of study with the aim of training of future engineers.

It should be marked that any engineer-graphic job is difficult to fulfill without mistakes if the student does not know stated GOSTs and standards and cannot solve simple graphical tasks. That is why graphical tasks should the element of complex task, which will provide synergies between topics of theoretical and practical material, which will promote generalization, specialization and deep realization of obtained knowledge. To activate cognitive activity it is necessary to concentrate attention of future engineers on the fact that each following task has the elements of known one and this will help to get ready to digestion of new data and solve the tasks independently.

On the base of the abovementioned one may state that successful formation of design-and-engineering competence is possible only during cognitive activity. During solution of concrete tasks of practical and theoretical character, future engineer should use the means of intellectual character: analysis, synthesis, generalization and also find algorithms according to which he will solve and forecast the result, which will satisfy the requirements of graphical task. For this purpose the student should observe, be able to perceive teaching information, analyze, hypothesize, compare facts and information, which contribute not only the understanding and memorizing of graphic material, but activation of cognitive activity.

So, suitable graphical tasks will induce future engineers to cognitive activity and the ability to use gain knowledge during further study. That is why knowledge, which student receives while studying graphical disciplines give the possibility to solve engineer-graphical tasks and term projects during further study of special disciplenes.

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