

**METHODS OF FORMING SPATIAL IMAGING IN ENGINEERING
GRAPHICS LESSONS**

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Abstract. This in the article engineering graphics in science in students spatial imagination of formation theoretical and practical aspects covered. In the article spatial imagination develop methods, including three projection drawings, physics models, mental exercises, construction-analytical approach and digital 3D modeling such as methods analysis Also, the study exercises system and digital technologies application through spatial thinking, graphic literacy and construction skills effective development pedagogical basics statement Article students complicated constructions understanding, analysis to do and create ability to increase aimed at methodical also give recommendations inside takes.

Key words:engineering graphics, spatial imagination, construction thought, three projection drawing, 3D modeling, mockup, mental exercises, graphics literacy.

Engineering graphics science education in the system role today's on the day increasingly increasing is going on, because it is not only students drawings with to work teaches, maybe their complicated construction systems understanding, analysis to do and creative approach with solution working exit ability This science, especially mechanical engineering, architecture, construction and industry design such as in the fields to students not only two size drawings understanding opportunity gives, maybe them three dimensional spatial imagination It also prepares for development. Therefore spatial imagination — engineering graphics science the most important cognitive from components one as is considered.

Spatial imagination from the student of the object its shape, its structure, dimensions and proportions in mind requires modeling, which and student technician to think directs, its creative and analytical thinking abilities develops. Engineering graphics in their classes to students drawings based on spatial objects imagination to do and they with work skills forming, complex constructions understanding and them again create opportunity Therefore, in this subject lessons spatial imagination to develop methodical in terms of systematic and step by step organization to grow separately importance profession will reach.

Spatial imagination is object or of the subject in space its location, three of size shape, size, proportions and construction elements between connections in mind modeling This is the ability . ability to the student drawings through object understand, its structure analysis to make, construction decisions assessment and complicated mechanic systems design opportunity gives.

Engineering graphics in their classes spatial imagination development student's future professional in the activity directly reflection will, because every how technician solution first of all visual and graphic model as is expressed. This therefore, spatial imagination formation process training in the process not only theoretical knowledge, maybe practical skills also to strengthen aimed at to be It is necessary. Process to the student complicated geometric shapes

analysis to do them in projections reflection continuation, sections and clippings through explanation and eventually constructive solutions working exit ability gives.

Spatial imagination develop methods

1. Three projection drawings based on spatial imagination harvest to do

Students three projection drawings with to work to teach engineering graphics in their classes main method This is in approach details front, top and side views separate to describe through them in space imagination to do opportunity The teacher creates each projection content step by step explaining and giving details simple geometric to the elements separate shows and to students them again collection opportunity gives . In this way students two size drawings through three dimensional the object imagination to do skill they develop.

2. Physicist models and models with work

To students different spatial shapes and constructive elements modeling through imagination to do skills formation possible. Plastic, cardboard or other from materials prepared models in students visual and tactile perception strengthens. With this together, complicated constructions step by step assembly and separation through student each of the object detail independent analysis does and his/her spatial structure in mind creates.

3. Digital technologies and 3D programs application

Modern engineering AutoCAD, SolidWorks, Autodesk Inventor, Kompas-3D in education programs to students three create a dimensional model, objects to twist, to straighten and sections visual in a way see opportunity gives. With this together, together constructions assembly to do and motion simulation done increase in students constructive thought and spatial imagination noticeable at the level develops. Digital modeling through student teacher to the instruction relied on without independent solution working comes out and own mistakes fast in a way determination as far as possible has will be.

4. Mental imagery exercises

Mental imagination exercises student's in mind objects rotate, crop , zoom or zoom in, different to projections separation skills For example, a student one turn the part 90° when turning which appearance harvest to be in advance imagination This type of exercises student's creative and analytical thinking strengthens and three size objects on a 2D plane understanding ability develops.

5. Structural-analytical approach

Structural-analytical in approach detail shape, size, details between distance and connection points analysis This approach is in students complicated constructions whole system as see and them step by step again create skills forms. In this way student constructive to think has will be, its graphic solutions create ability develops and it is any complicated object analysis do able to to the level enough .

Engineering graphics in their classes spatial imagination to form — students future professional to activity preparation the most important condition is considered. Spatial imagination develop for models with work, three projection drawings based on education, digital 3D modeling, mental imagination exercises and structural-analytical approach such as methods together application demand This is methods systematic and step by step done If increased, students engineering and technical thought expands, graphic competencies reinforced, structural solutions on creative work ability takes shape and they future practical to activity thorough is prepared.

Spatial imagination to develop aimed at systematic approach, to students not only drawing with to work teaches, maybe them complicated technician objects conscious accordingly to modeling and practical solutions working to go out prepares. This therefore, spatial imagination

formation methods teaching to the process regular and step by step current to grow modern engineering education efficiency in increasing important importance profession will reach.

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