Chizmachilik darslarida tutashmalarni formulaviy va vizual-mnemonik yondashuv asosida o‘rgatish metodikasi

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Annotatsiya: Mazkur maqolada chizmachilik darslarida tutashmalar mavzusini o‘rgatish jarayonida uchraydigan metodik muammolar tahlil qilinadi va ularni bartaraf etishga qaratilgan innovatsion yondashuv taklif etiladi. Tutashmalarni chizishda talabalar tomonidan ko‘p uchraydigan xatolar, xususan tutashma yoyining markazini aniqlash hamda tashqi va ichki tutashmalarni farqlashdagi qiyinchiliklar asoslab beriladi. Maqolada tutashmalarni formulaviy mantiqqa tayangan holda, shu bilan birga vizual-mnemonik assotsiatsiyalar orqali tushuntirish metodikasi yoritilgan. Taklif etilayotgan yondashuv chizmachilik fanini o‘qitishda mavzuni sodda, tushunarli va esda qolarli tarzda o‘zlashtirishga xizmat qiladi hamda talabalarning amaliy mashg‘ulotlardagi faolligi va bilimlarining mustahkamligini oshirishga imkon yaratadi.

Kalit so‘zlar: chizmachilik, tutashma, tashqi tutashma, ichki tutashma, geometrik yasash, vizual assotsiatsiya, mnemonik metodika, interaktiv o‘qitish

Teaching Methodology of Tangencies in Engineering Drawing Based on a Formulaic and Visual-Mnemonic Approach

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Abstract: This article analyzes methodological problems encountered in the process of teaching the topic of tangencies in engineering drawing classes and proposes an innovative approach aimed at eliminating them. Common mistakes made by students when constructing tangencies are substantiated, particularly difficulties in determining the center of the tangent arc and distinguishing between external and internal tangencies. The article explains a methodology based on formulaic logic while simultaneously clarifying the topic through visual-mnemonic associations. The proposed approach serves to master the subject in a simple, understandable, and

memorable way in teaching engineering drawing, and creates opportunities to increase students' activity during practical lessons as well as the durability of their knowledge.

Keywords: engineering drawing, tangency, external tangency, internal tangency, geometric construction, visual association, mnemonic methodology, interactive teaching

Chizmachilik fanida tutashmalar mavzusi geometrik yasashlarning muhim bo‘limlaridan biri bo‘lib, u talabalarda fazoviy tafakkur, mantiqiy fikrlash va grafik savodxonlikni shakllantirishda muhim o‘rin tutadi. Aylana va to‘g‘ri chiziqlarni yoki aylana–aylana elementlarini silliq bog‘lash jarayonida tutashma yoyining markazini aniqlash hamda radiuslar o‘rtasidagi matematik munosabatlarni to‘g‘ri qo‘llash talab etiladi. Amaliy tajribalar shuni ko‘rsatadiki, talabalar ko‘pincha tutashma turini aniqlashda va ayniqsa radiuslarning qo‘shilishi yoki ayirilishini farqlashda qiyinchiliklarga duch keladi. Shu sababli tutashmalarni o‘rgatishda an’anaviy geometrik yondashuvni eslab qolishni osonlashtiruvchi metodik usullar bilan boyitish zarur hisoblanadi. Aylana tutashmasining ilmiy asosi tutashma yoyining markazi berilgan aylana markazlaridan ma’lum masofada joylashish shartiga tayanadi. Berilgan aylanalarning markazlari mos ravishda O_1va O_2, radiuslari esa va R_1 va R_2 bo‘lsin. Tutashtiruvchi yoyning radiusi R bilan belgilanadi. Tutashma yoyining markazi O shunday tanlanadiki, tutashma turi (tashqi yoki ichki)ga qarab masofalar quyidagi formulalar orqali aniqlanadi.

Tashqi tutashmada tutashma yoyi berilgan aylanalarga tashqi tomondan urinadi. Bu holatda geometrik shart shundan iboratki, tutashma yoyining markazidan har bir berilgan aylana markazigacha bo‘lgan masofa radiuslarning yig‘indisiga teng bo‘ladi, ya’ni:

$$OO_1=R+R_1,\ OO_2=R+R_2$$

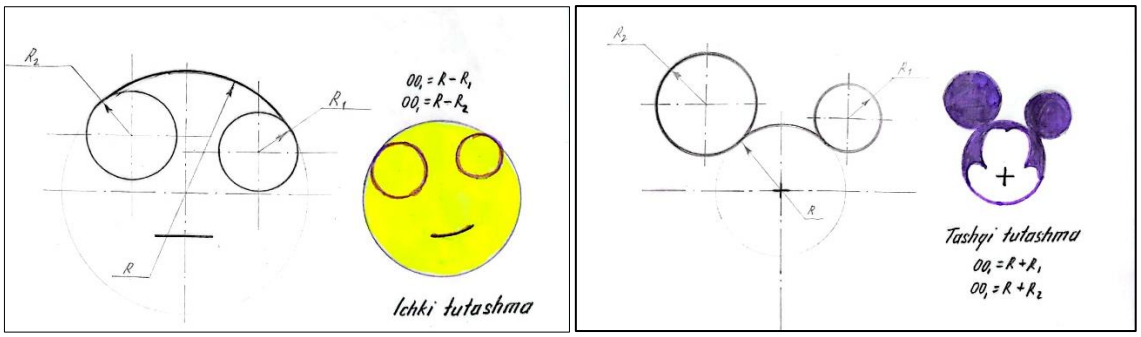
Mazkur formulalar tashqi tutashmada radiuslar qo‘shilishi asosiy qoida ekanligini ko‘rsatadi. Amaliy yasash jarayonida bu qoida yordamchi aylanalar orqali amalga oshiriladi: O_1 markazdan radiusi $R+R_1$, O_2markazdan radiusi $R+R_2$ bo‘lgan aylanalar chizilib, ularning kesishgan nuqtasi tutashma yoyining markazi sifatida olinadi. Ichki tutashmada esa tutashma yoyi berilgan elementlarning ichki tomonida joylashadi. Bu holatda masofa radiuslar ayirmasi orqali aniqlanadi:

$$OO_1=R-R_1,\ OO_2=R-R_2$$

Demak, ichki tutashmada asosiy e’tibor radiuslarning ayirilishiga qaratiladi. Yordamchi aylanalar mos ravishda $R-R_1$va $R-R_2$ radiuslar bilan chizilib, ularning kesishish nuqtasi tutashma yoyining markazini beradi. Ushbu formulaviy farq tashqi va ichki tutashmalar o‘rtasidagi asosiy nazariy tafovutni tashkil etadi.

Mazkur formulaviy asosni talabalarga tez va mustahkam o‘zlashtirishga yordam berish maqsadida vizual-mnemonik metodika taklif etiladi. Ushbu metodikada

geometrik yasashlar kundalik hayotda tanish bo‘lgan obrazlar bilan bog‘lanadi. Tashqi tutashmada tutashtiruvchi yoyni hayolan davom ettirganda hosil bo‘ladigan umumiy shakl “Mikki Maus” obraziga o‘xshash ko‘rinish hosil qiladi. Ushbu obrazda markaz qismiga “+” belgisi joylashtiriladi, bu esa tashqi tutashmada radiuslar qo‘shilishini ($R + R_1$, $R + R_2$) eslatib turuvchi mnemonik belgivazifasini bajaradi.



Ichki tutashmada esa tutashtiruvchi yoyni hayolan davom ettirish natijasida ichkarida “ko‘z” yoki “yig‘layotgan stiker”ga o‘xshash shakl hosil bo‘ladi.

Bu tasvir ichki tutashmada radiuslarning ayirilishini ($R - R_1$, $R - R_2$) eslab qolishga yordam beradi. Ushbu yondashuvning muhim jihati shundaki, vizual obrazlar formulani almashtirmaydi, balki formulaviy qoidani mustahkamlovchi didaktik vosita sifatida xizmat qiladi. Talaba har bir yasashdan oldin tutashma turini aniqlab, avtomatik ravishda mos algebraik amalni tanlaydi. Natijada tutashma markazini noto‘g‘ri topish, yordamchi radiuslarni xato belgilash kabi keng tarqalgan xatolar sezilarli darajada kamayadi.

Xulosa qilib aytganda, chizmachilik darslarida tutashmalarni formulaviy asos ($R \pm R_1$, $R \pm R_2$) bilan birgalikda vizual-mnemonik metodika orqali o‘rgatish o‘quv jarayonining samaradorligini oshiradi. Ushbu metodika talabalarning mantiqiy va fazoviy tafakkurini rivojlantiradi, murakkab geometrik yasashlarni sodda va tushunarli shaklda o‘zlashtirishga imkon yaratadi hamda amaliy mashg‘ulotlar sifatini yaxshilaydi.

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