Magdalena DRAGOVIĆ[1]**, Svetlana ČIČEVIĆ**[2]**, Aleksandar ČUČAKOVIĆ**[1]**,
Aleksandar TRIFUNOVIĆ**[2]**, Filip GRAMIĆ**[1]
University of Belgrade
[1]Faculty of Civil Engineering
Dep. of Math., Phys. and Descriptive Geometry
Bulevar kralja Aleksandra 73/I, 11000 Belgrade, Serbia
phone./ fax: +381 11 3218 571   e-mail: dim@grf.bg.ac.rs
[2]Faculty of Transport and Traffic Engineering
Vojvode Stepe 305, 11000 Belgrade, Serbia

POSITIVE IMPACT OF 3D CAD MODELS EMPLOYMENT IN DG EDUCATION

Keywords: *Descriptive geometry, 3D geometric models, spatial perception.*

Classical Descriptive Geometry (DG), an engineering students' important course, uses 2D drawings for 3D spatial elements representation. The efficient engineering practice for solving geometry tasks used to be on sheet drawings prior to computer era. Computer graphic introduced simulation of a 3D geometric environment (such as 3D modeling software, augmented and virtual reality) in contemporary DG teaching. Such trends influence spatial perception skills improvement, knowledge achievements, as well as learning motivation enhancement. The aim of the research is the impact of CAD models utilization in correlation to students' evaluation scores, learning style, and motivation level.

The research was performed on the freshmen students sample attending DG course at Civil Engineering Faculty of Belgrade University. DG lecturing combines blackboard drawings, PowerPoint presentations, and 3D AutoCAD models. The practices are organized as classical geometric tasks to be manually performed in form of sheet drawings; using geometry accessories with the teacher's guidance/assistance. Handouts - conceived tasks, and AutoCAD solutions (Figure 1) are available at the official Faculty's website. The approximate of 130 students sample size taken from three generations of civil engineers (2014-2016) were monitored and inquired succeeding the final exam success.
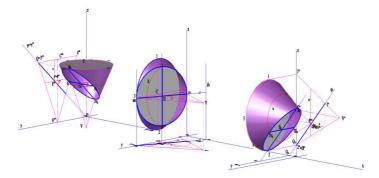
Fig. 1 Handouts: 3D representation of the topic - conics sections (AutoCAD models)

Paper based questionnaire (constructed by the authors for the purpose of this study) was employed. Data entries from Microsoft Excel spreadsheet were imported into IBM SPSS Statistics base. Frequency histograms and the Kolmogorov-Smirnov Test were used to determine whether the mean scores obtained during testing had a normal distribution. Since the distribution of all interval variables significantly deviated from the normal distribution, the nonparametric Mann-Whitney's rank sum test was imployed. The results have shown significant contribution after 3D models assistance introduction in DG teaching/learning process, regarding students' motivation level and success evaluation.

References:

[1]   Chen D. M.: *Application of 3d CAD for basic geometric elements in descriptive geometry.* Engineering Design Graphics Journal, Vol. 64:1, 2000, p. 10-17

[2]   Marunić G., Glažar V.: *Improvement and assessment of spatial ability in engineering education*, Engineering Review, Vol. 34:2, 2014, p.139-150

[3]   Standiford K., Standiford D.: *Descriptive Geometry. An Integrated approach Using AutoCAD.* 2ⁿᵈ ed. Delmar Cengage Learning, NY, USA, 2006.

[4]   Veide G., Leja E., Dobelis M.: *Integrating 3D CAD Applications into Descriptive Geometry and Engineering Graphics Studies. Proceedings of 5th Conference "Geometry and Graphics"*, Ustron, Poland, June, 2007., p.56-56.