

# Geometric constructions problems in dynamic environment: new elegance and new dilemmas in teacher training

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After almost two decades of ignoring the issue of construction with straightedge and compass in Israeli high school curricula, they came back to textbooks together with technologies and interactive geometry software (IGS). The IGS offers students to discover the properties of geometric objects in the style of inquiry as a process of problem posing and problem solving. The presentation discusses horizons and dilemmas of using dynamic geometry environment for solutions of construction problems in teacher training. Among didactic dilemmas we mention the existing of 'non-classic' tools of GeoGebra with allow almost immediate solutions of some 'difficult' construction problems (for example, three circles Apollonius problem), and the students' use of built-in tools for simple geometric constructions. Concerning straightedge-and-compass construction problems, we suggest the approach based on using the idea of interplay of change and invariance [1, 2]. This approach provides the solution in the manner that fits the typical way of reasoning of students. Since they have a difficulty to build geometrical object that simultaneously satisfies different requirements, we suggest to split a whole problem into multiple stages with the single construction demand at each one. Technically, the approach use tracing as a tool to discover a hidden invariant and to construct a suitable change. The approach is illustrated with solutions of constructions problems that involve different transformations of intermediate object: translation, homothety and others.

## References

- [1] I. Sinitsky and B. Ilany, *Change and Invariance. A textbook on Algebraic Insight into Numbers and Shapes.*, Sense Publishers, Rotterdam/Boston/Taipei (2016).
- [2] I. Sinitsky and M. Stupel, *Invariants in geometry: a long-term history and current implications for learning.*, Levenberg, I.& Patkin, D.(eds.), The many aspects of geometry - From research to practice in geometry teaching. <sup>nd</sup> ed., MOFET, (2017, in Hebrew).