PROBLEM POSING AND PROBLEM SOLVING OF GEOMETRICAL CONFIGURATIONS BY INTEGRATING DYNAMIC GEOMETRY SOFTWARE

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Our purpose is to describe research of prospective teachers using a geometrical configuration, which was carried out with the WIN ("What if Not") method by integrating dynamic geometry software. The prospective teachers integrated problem posing and problem solving, handled "prove" and "find" problems as recommended by Polya. The vast majority of the prospective teachers reported that they "are doing math", and as Brown & Walter mentioned, they perceived themselves as participants rather than spectators. Most of the prospective teachers recommended integrating courses dealing with WIN inquiry to train mathematics prospective teachers as well as presenting it in the high school curriculum, in order to raise motivation and to deepen the knowledge pool of learners.

Mathematical Problem Solving (PS) and Problem Posing (PP)

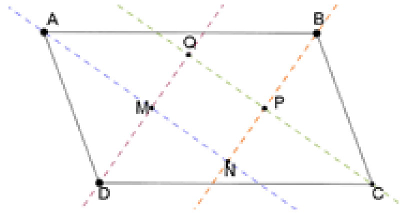
Hoehn (1991) claims that as opposed to very many studies on the subject of PS, the subject of PP has not received sufficient attention. This claim was supported by Brown & Walter (1993), who proposed the WIN method and opened up courses for prospective teacher's based upon this method. The WIN method includes: changing data, reducing data, adding data, analogy, looking for invariants, and checking extreme cases. The goal of Brown & Walter was to turn learner from a "spectator" into a "participant". PP is recognized as an important element in the process of teaching and learning (NCTM, 2000).

Integration of DGS in mathematics teaching

DGS helps learners solve problems by studying examples. The ability of DGS to rapidly generate numerous, diverse examples, to store and restore moves, and to provide qualitative feedback provides the learner with valuable information concerning the mathematical concept(s) under study; information that constitutes a basis both for generalizations and for hypotheses which require proof (Goos, 2000; Heinze & von Ossietzky, 2002).

Martinovic & Manizade (2013) recognize the role of DGS as a partner in the learning process of mathematical justification.

The chosen configuration:



The internal bisectors of a parallelogram ABCD intersect at points MNPQ.

1. a)Prove that MNPQ is a rectangle, b)Prove that AB, CD || MP ; BC, AD|| QN, c) Calculate MP and QN by the sides of the parallelogram.
2. Using the WIN method and GeoGebra, formulate your hypotheses and prove or disprove them.
3. Formulate new questions deriving from your enquiry.

The following table gathers the frequency of the predicted results within the framework of the PT research work

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Item	Number and percentage of PT who arrived at the correct hypothesis and proved it.	Number and percentage of PT who arrived at the correct hypothesis without proof.
1(a)	$\frac{61}{61}$ (100%)	
1(b)	$\frac{61}{61}$ (100%)	
1(c)	$\frac{58}{61}$ (95%)	$\frac{3}{61}$ (5%)
1(d)	$\frac{53}{61}$ (87%)	$\frac{8}{61}$ (13%)
1(e)	$\frac{45}{61}$ (74%)	$\frac{6}{61}$ (10%)
2(a)	$\frac{35}{61}$ (57%)	$\frac{16}{61}$ (26%)
2(b)	$\frac{35}{61}$ (57%)	$\frac{16}{61}$ (26%)
2(c)	$\frac{6}{61}$ (10%)	$\frac{40}{61}$ (66%)
2(d)	$\frac{5}{61}$ (8%)	$\frac{20}{61}$ (33%)
2(e)	$\frac{10}{61}$ (16%)	$\frac{35}{61}$ (57%)
3(a)	$\frac{55}{61}$ (90%)	$\frac{4}{61}$ (7%)
3(b)	$\frac{50}{61}$ (82%)	$\frac{4}{61}$ (7%)

Item	Number and percentage of PT who arrived at the correct hypothesis and proved it.	Number and percentage of PT who arrived at the correct hypothesis without proof.
3(c)	$\frac{48}{61}$ (79%)	$\frac{3}{61}$ (5%)
3(d)	$\frac{4}{61}$ (7%)	$\frac{5}{61}$ (8%)
3(e)	$\frac{3}{61}$ (5%)	$\frac{50}{61}$ (82%)

Table 1: results within the framework of the PT research work.

Prospective Teachers attitudes towards the enquiry process

The use of the GeoGebra as an invaluable tool for the enquiry process: "*the use of the GeoGebra software infused me with confidence, and it has been, for me, a valuable tool in determining the research question", "we could easily observe the relations between the exterior and internal angles, between the lengths…"* .

The activity refreshed mathematical and pedagogical knowledge: "*this activity made me think of all the theorems that I have learned and I had to recall them", "I have learned how to present, during lessons, a research activity, integrating a technology".*

The activity was intriguing: at every stage, the PT discovered something, which encouraged them to ask another question: *"the activity encourages thinking about new things".*

The activity was challenging and rarely frustrating: "*it took us a long time to prove some of our hypotheses. But the process gave us very much and when we finished we felt proud and satisfied".*

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