Regular Polygons:
From Scratch to Construit!

School: Ralleia Experimental Primary Schools

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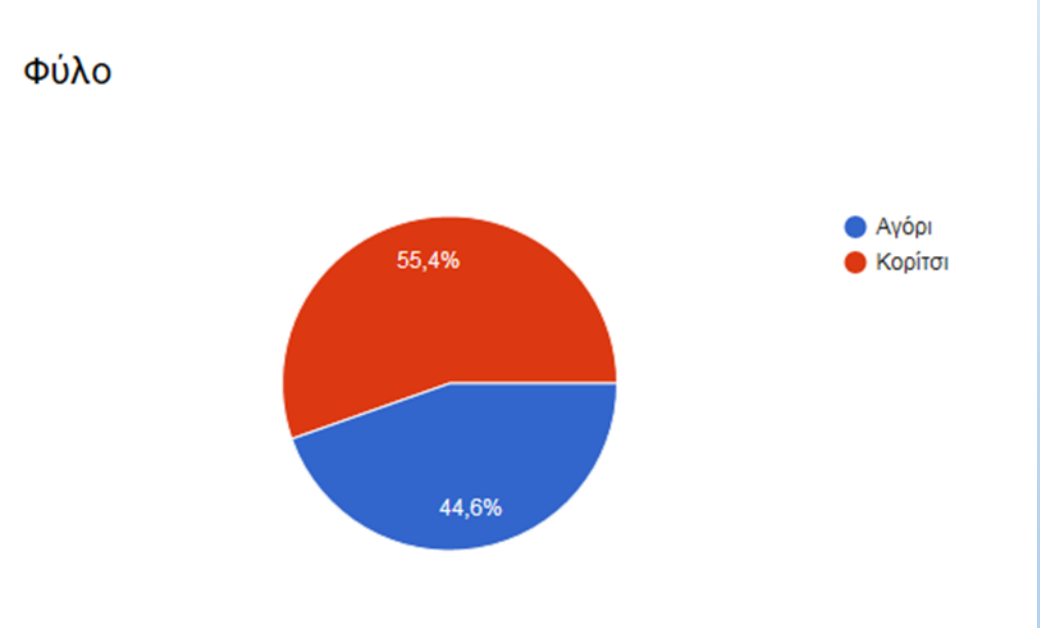
May-June, 2017

"Construit 2007 Making Thinking and Learning in the Digital Age", 13-16 July 2017, University of Warwick, UK

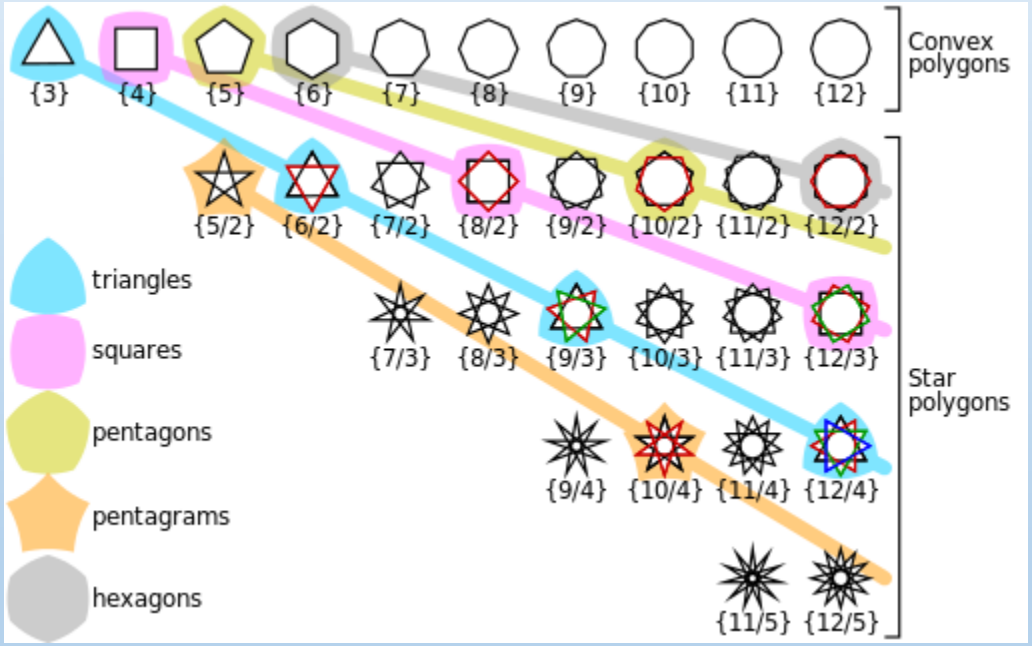
Sample

- 3 Classes 72 pupils
- 44,6 Male/55,4 Female
- A mixed 5th & 6th grade Class(20 pupils)
- A 5th grade Class (26 pupils)
- A 6th grade Class (26 pupils)

Sex

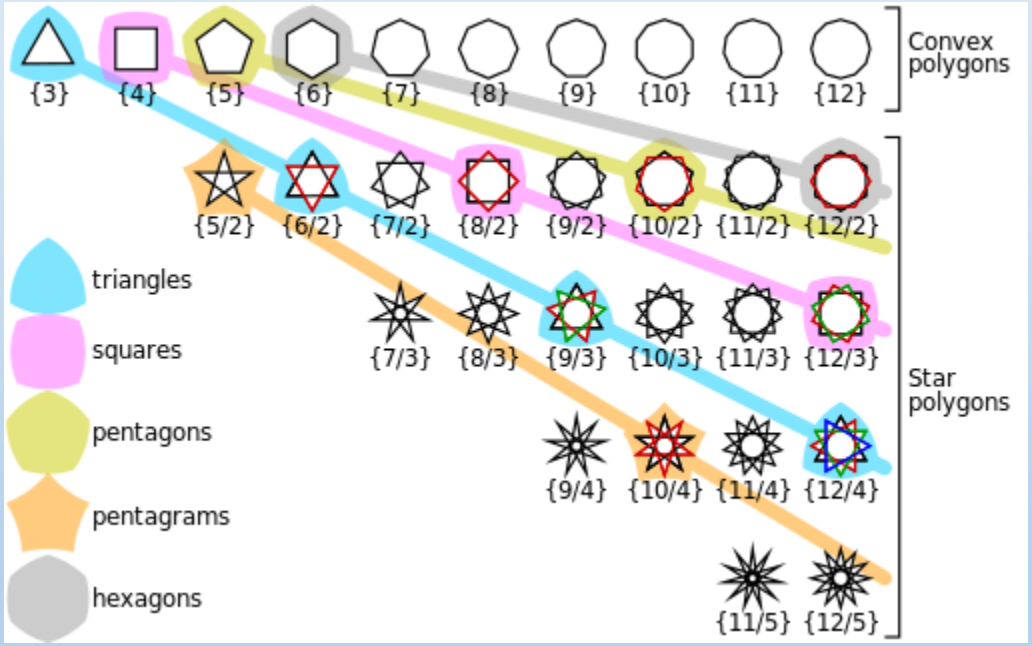


The problem: Convexing Regular Polygons



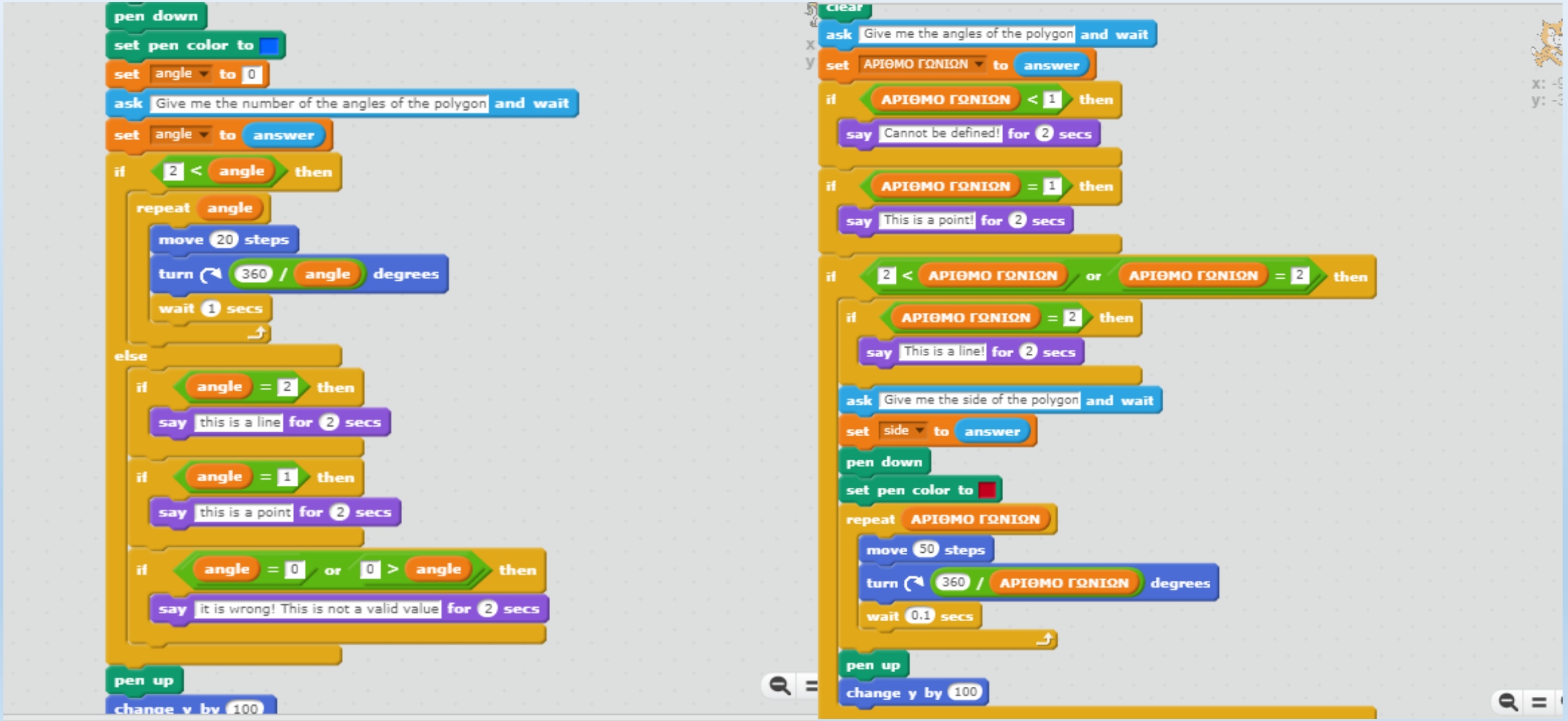
- Convexing Regular Polygons
- Logo like use of Scratch for polygon drawing-construction.
- 3-45’ lessons.
- Parameterization of polygon construction giving the:
  - Starting point,
  - Number of sides,
  - Size of sides.

Previous Knowledge on Maths



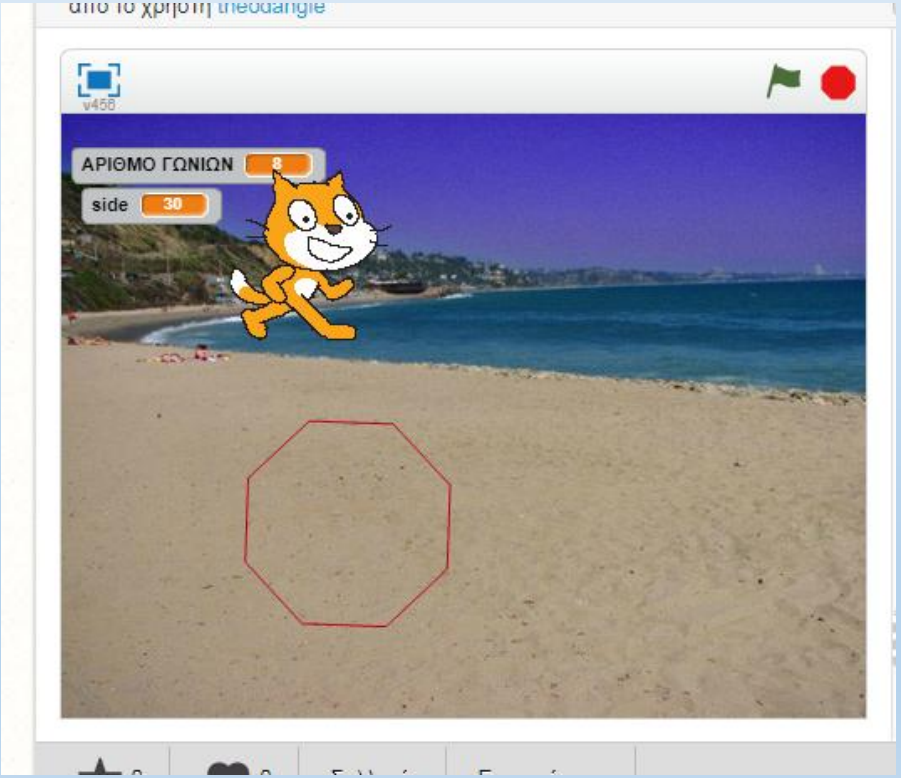
- Drawing with Scratch.
- Circle: Radius-Diameter-Perimeter.
- Line starting from certain point.
- Direction of a line.
- Turning of sprite certain number of angles.

Regular Polygons Drawing:
Same Problem different Solutions.
More at: https://scratch.mit.edu/studios/4179144/

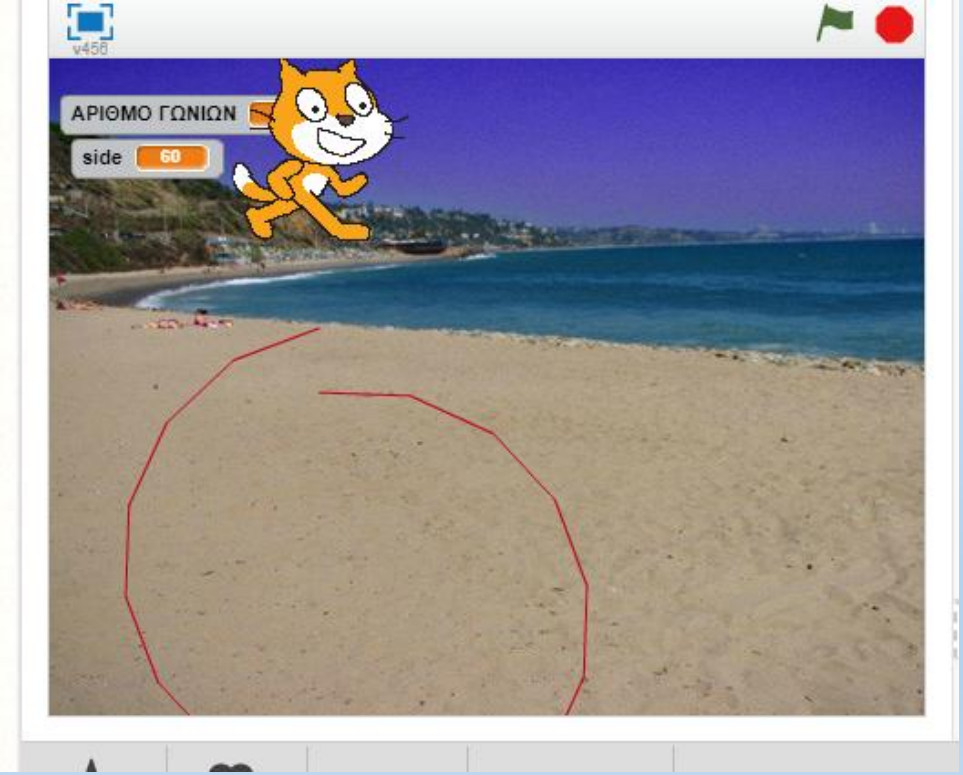


Accuracy…floating point numbers

8 side-30 pixels



12 side – 50 pixels



JS-Eden: Regular Polygon Construal
More at: jseden.dcs.warwick.ac.uk/construit/?load=210

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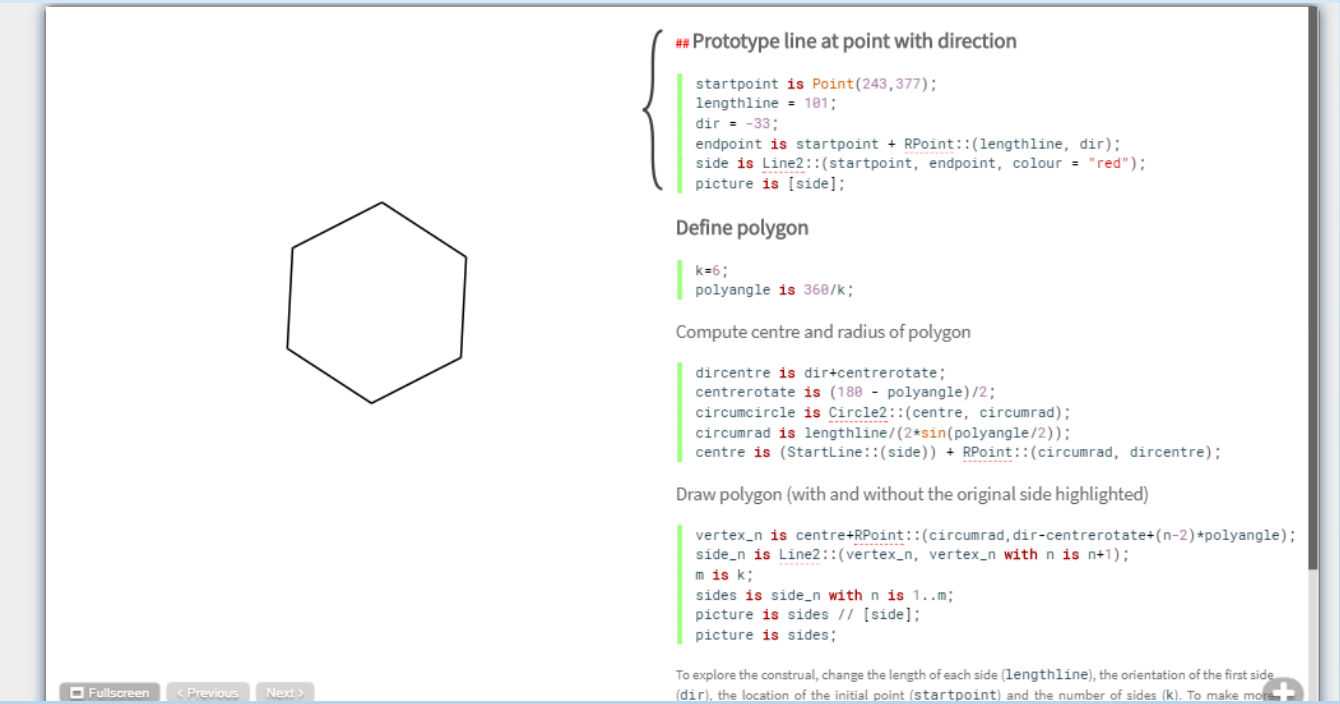


A Regular Polygon Construal was given to pupils to experiment themselves on the construction of regular polygon for a 45’ lesson.

Questionaires

Self-Evaluation/JS-Eden Evaluation

Κατάλαβα πως μπορώ να αλλάξω το μέγεθος της πλευράς του πολυγώνου Change the size of reg. Polygons side

- 1. Καθόλου /Not at all
- 2 Λίγο/Little
- 3 Αρκετά/ Enough
- 4 Πολύ Καλά/ Very well
- 5. Άριστα/ Excellent

Κατάλαβα πως μπορώ να αλλάξω το πλήθος των γωνιών του πολυγώνου I understand how to change the num of angles of the reg. Polygon

- 1. Καθόλου /Not at all
- 2 Λίγο/Little
- 3 Αρκετά/ Enough
- 4 Πολύ Καλά/ Very well
- 5. Άριστα/ Excellent

Κατάλαβα πως μπορώ να μετακινήσω το πολύγωνο στο χώρο/ I understand how to move the polygon on the canvas.

- 1. Καθόλου /Not at all

Learning Outcome Evaluation: Multiple-Choice Test

Οι γωνίες ενός κανονικού πολυγώνου είναι μεταξύ τους:/The angles of a regular polygon are:

- 1. Όλες διαφορετικές/All different
- 2. Όλες 90 μοιρών/ All 90 degrees
- 3 Όλες Ίσες μεταξύ τους/ All equal

Οι πλευρές ενός κανονικού πολυγώνου είναι μεταξύ τους:/The sides of a regular polygon are:

- 1. Όλες διαφορετικές/All different
- 2. Όλες 90 εκατοστών / All 90 cm
- 3 Όλες Ίσες μεταξύ τους/ All equal

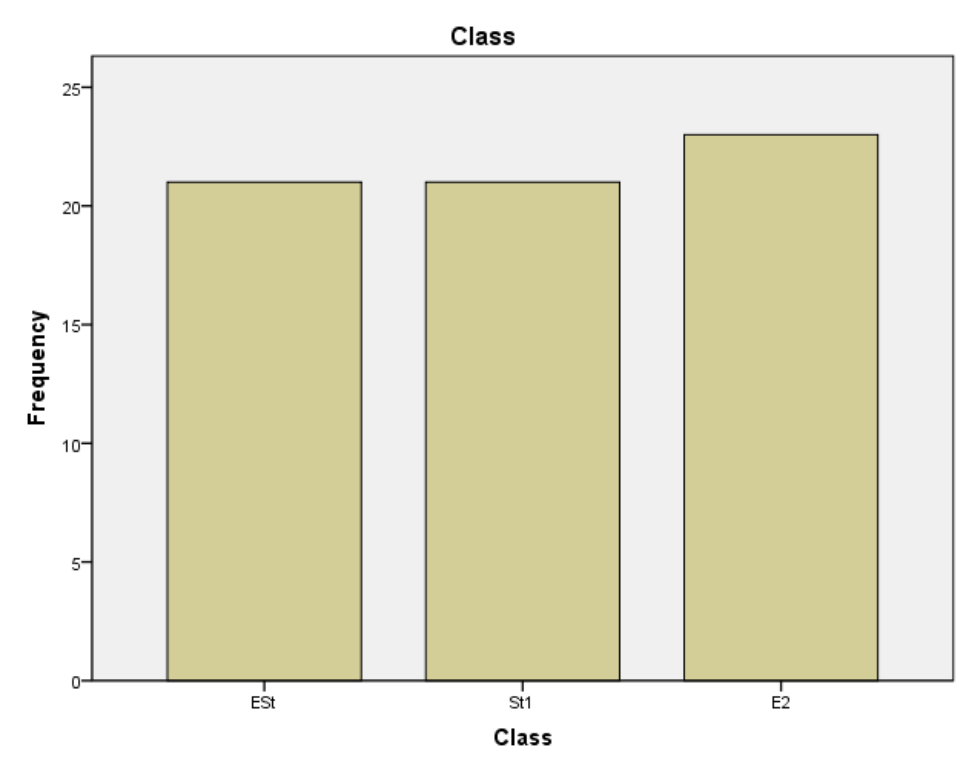
Σε ένα κανονικό τρίγωνο οι μοίρες των γωνιών του είναι:/On a regular triangle the degrees of each angle are

- 90
- 120
- 60
- 100

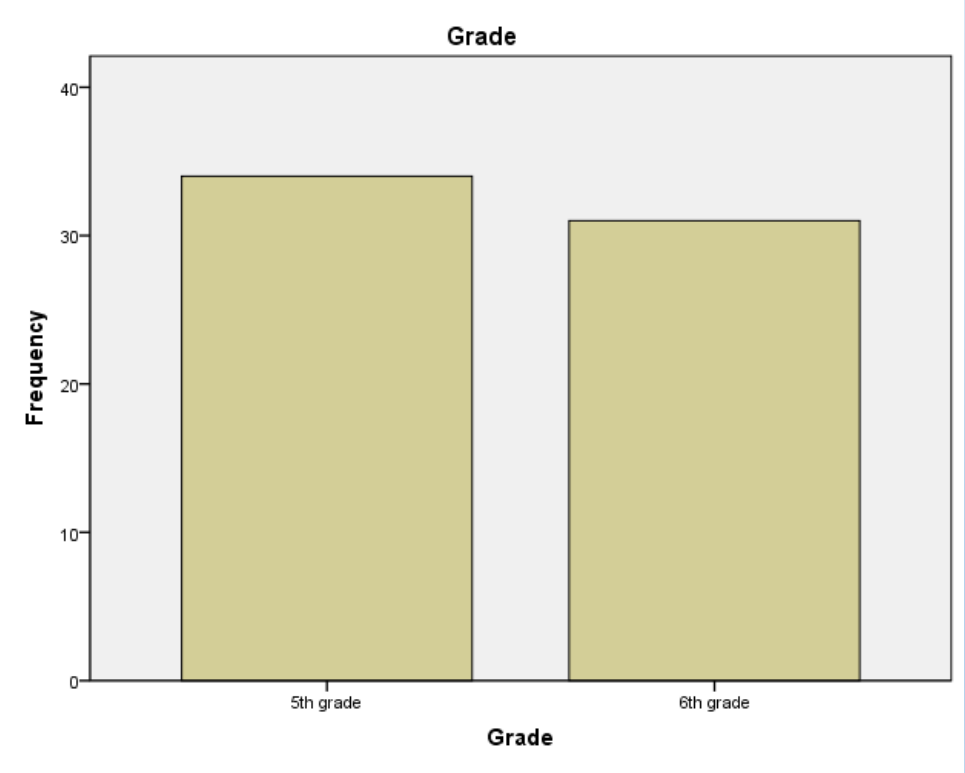
Πόσες μοίρες χρειάζεται να στρίψει ο γατούλης του Scratch για να σχηματίσει ένα ισόπλευρο τρίγωνο/How many degrees has the Cat sprite of Scratch to turn in order to make a equal

Sample Classes and Grade

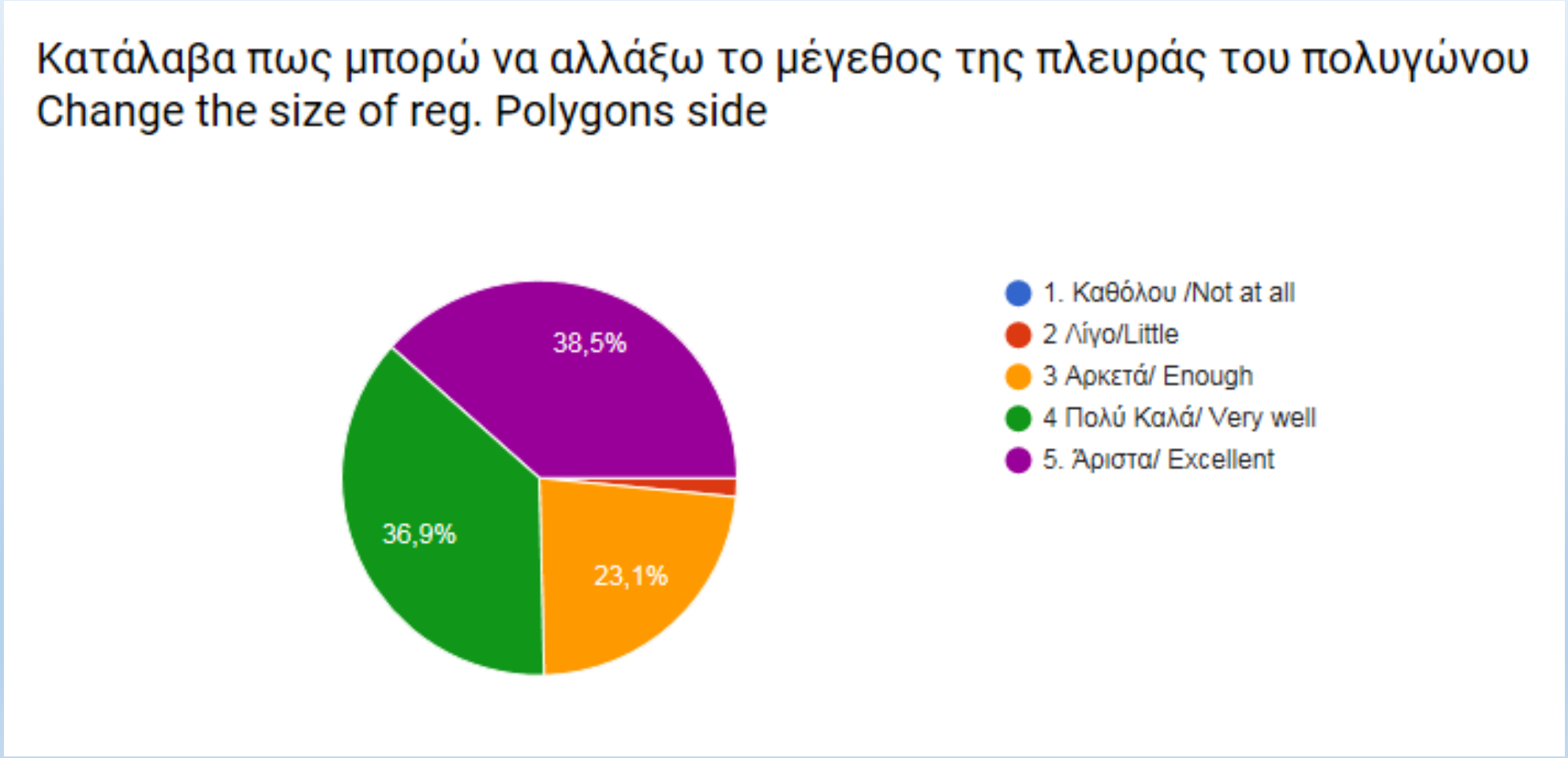
No of pupils/Class



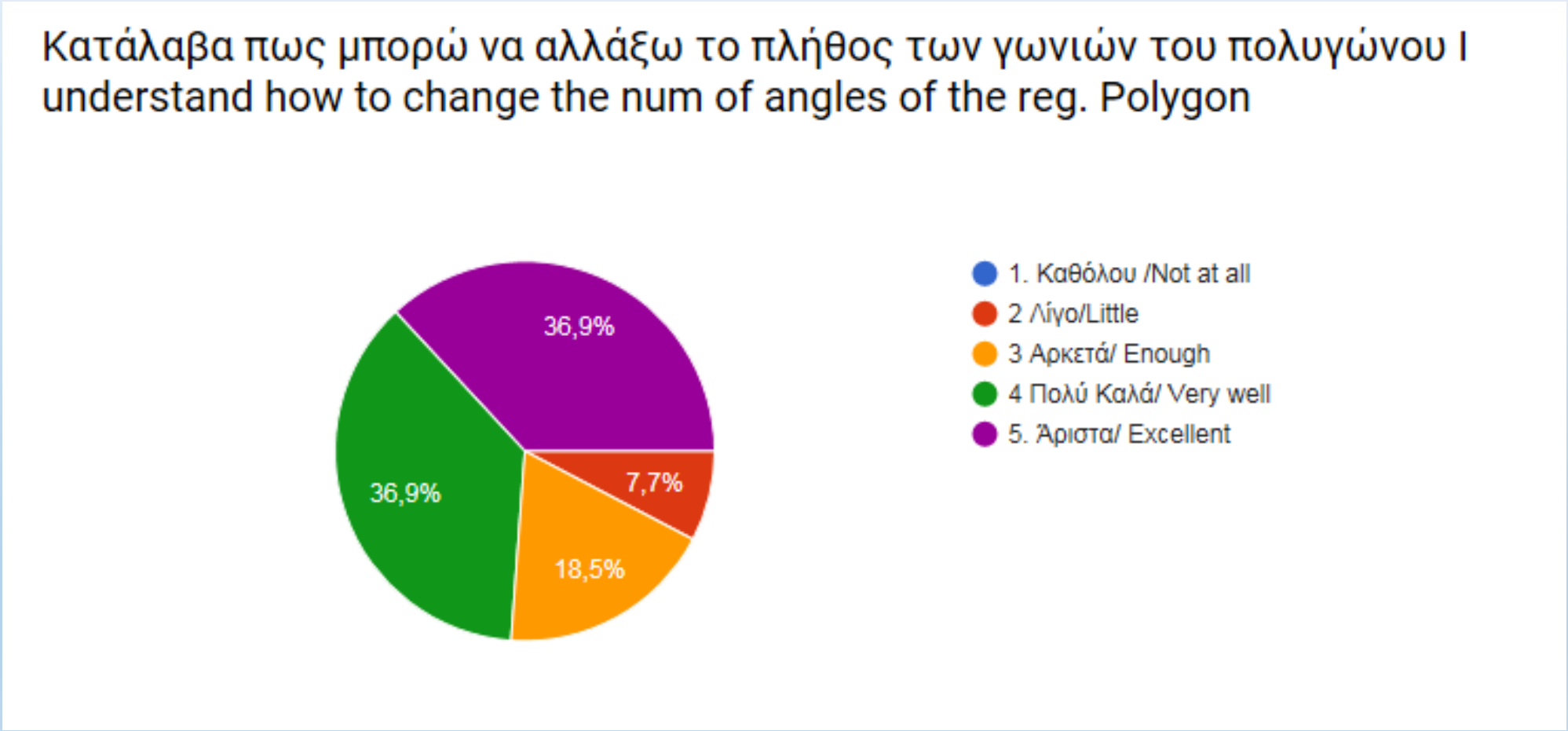
No of pupils/Grade



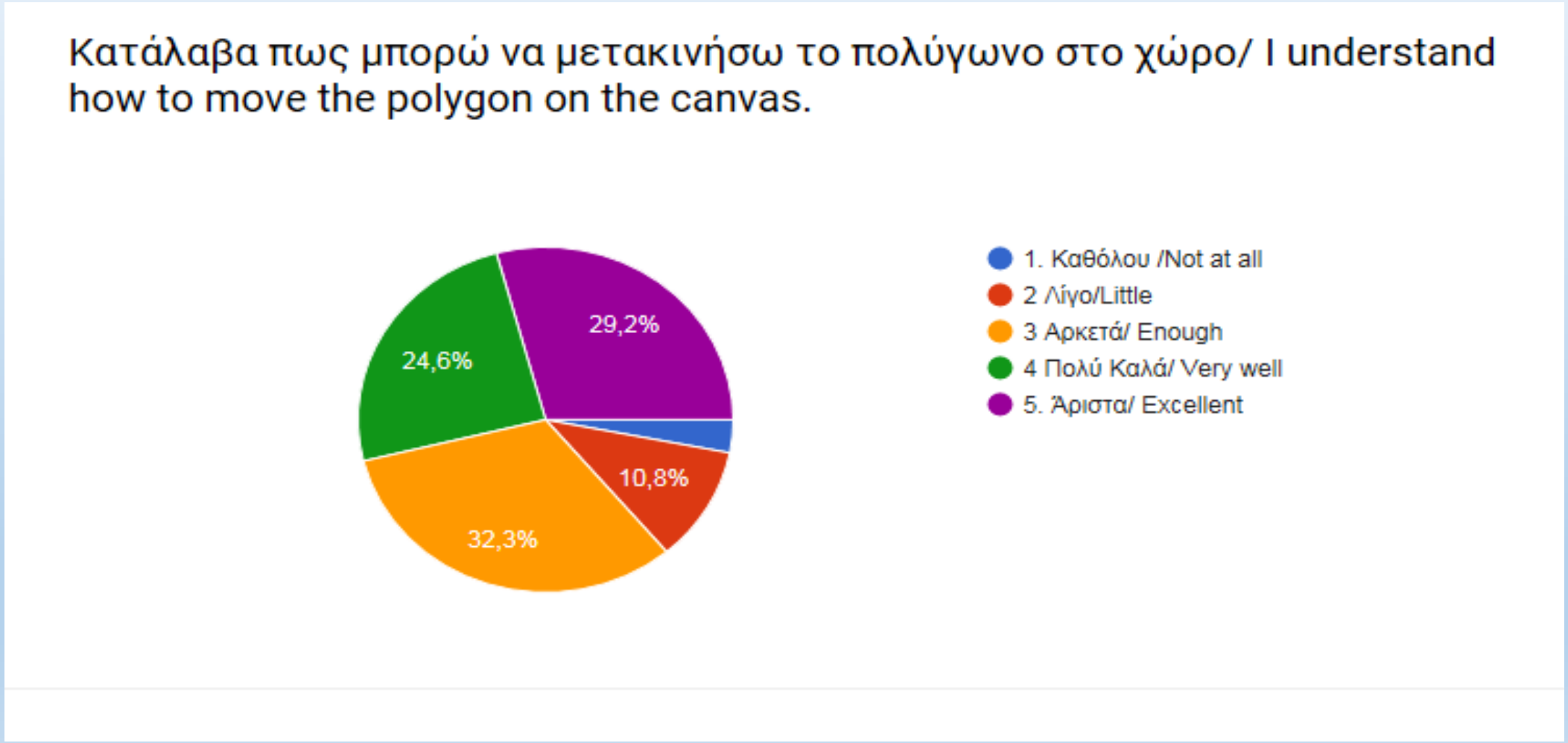
Self Evaluation: “I Understand how to change the size of reg. Polygon Side on JS Eden” 75,4% answered from Very Well to Excellent.



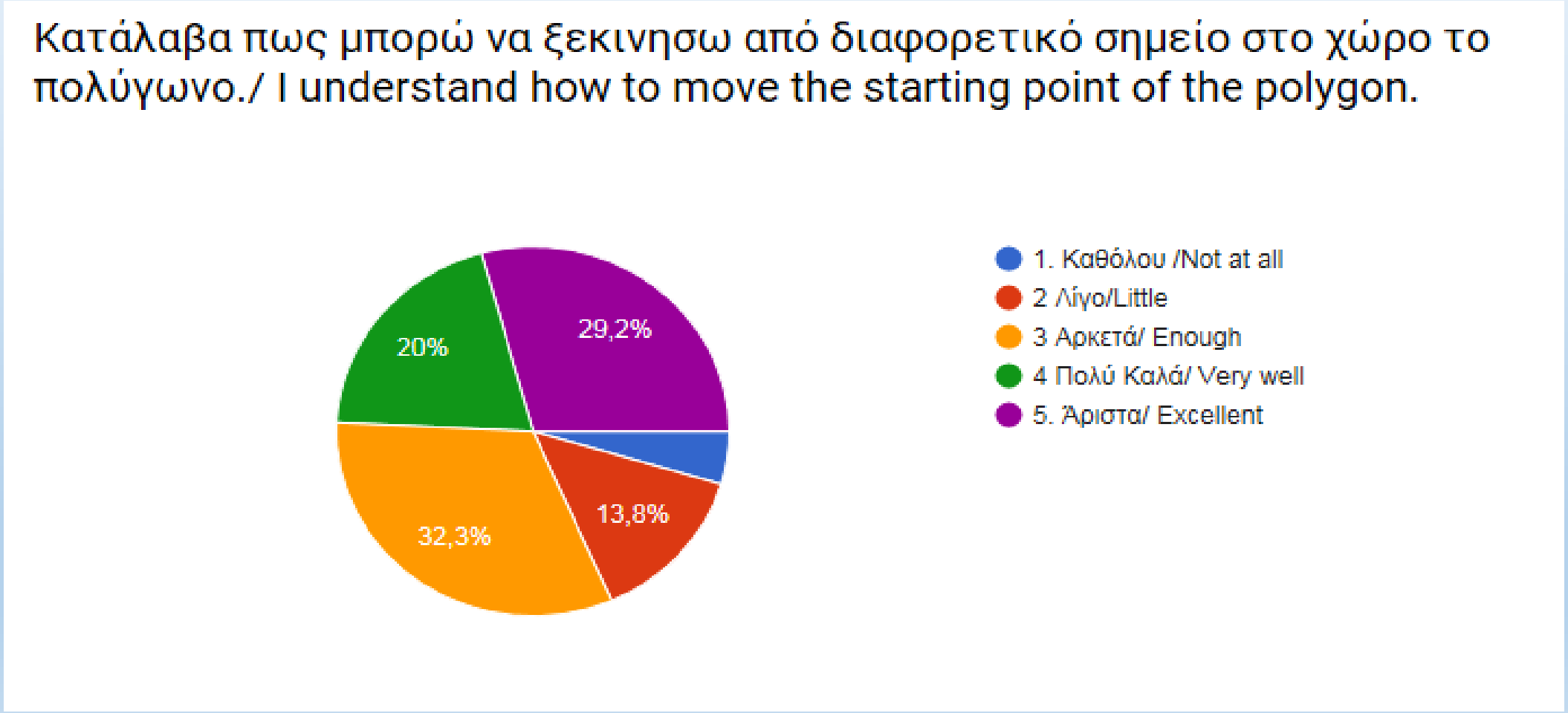
Self Evaluation: “I Understand how to change the number of angles of reg. Polygon on JS Eden” 73,8% answered were from Very Well to Excellent.



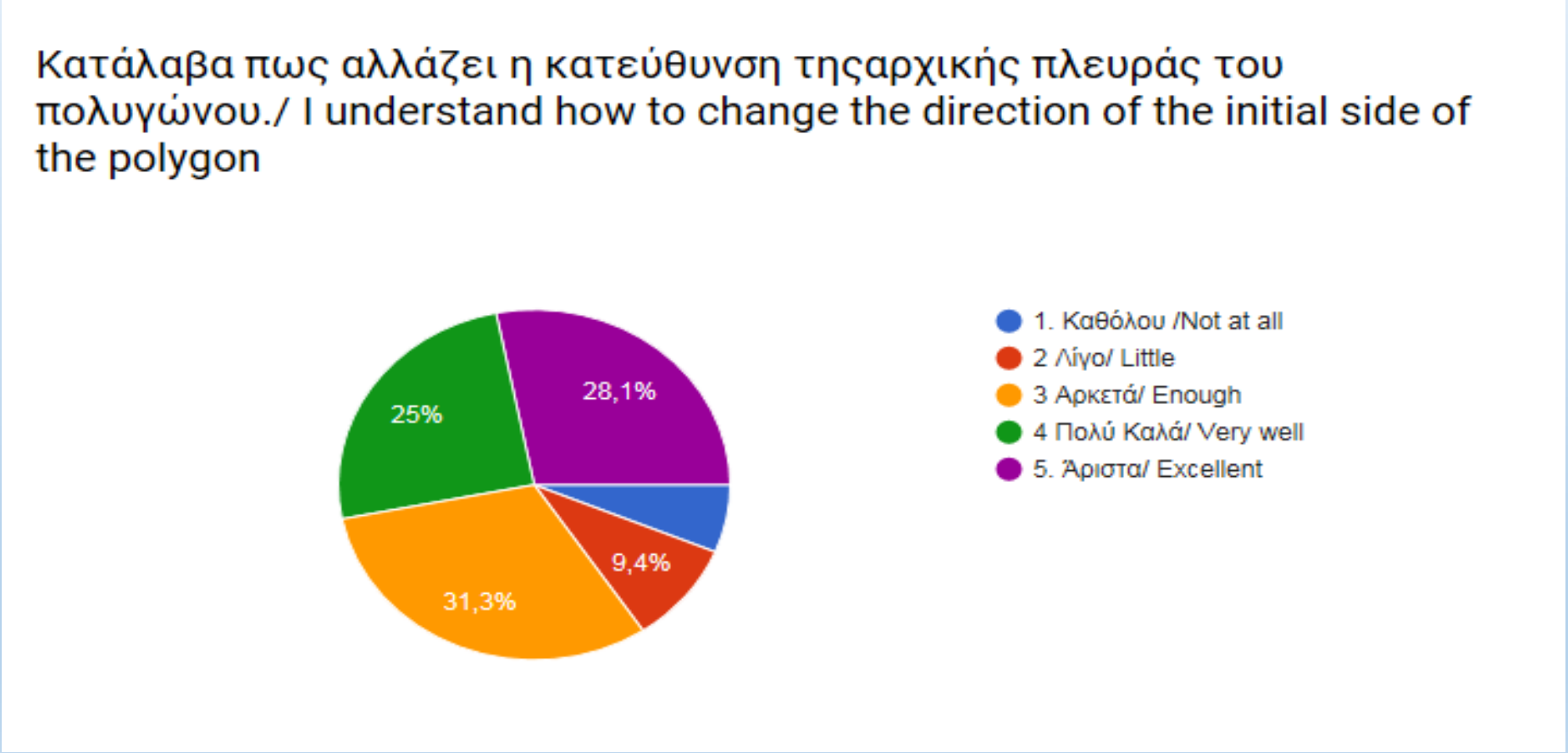
Self Evaluation: “Understand how to move the regular Polygon on the Canvas” 86,1% answers were from Enough to Excellent.



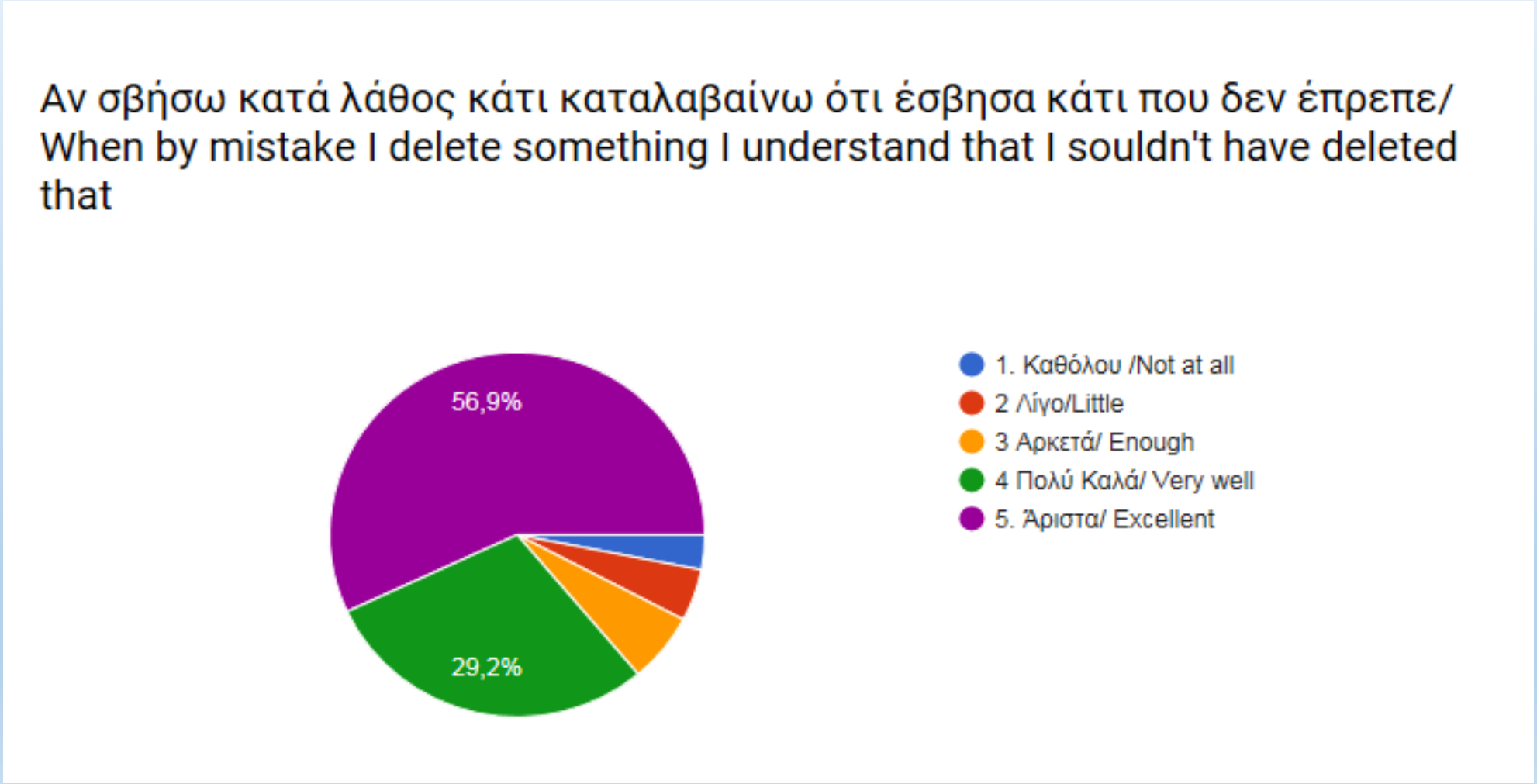
Self Evaluation:
“I Understand how to move the starting point of the polygon.” 81,5% answers were from Enough to Excellent.



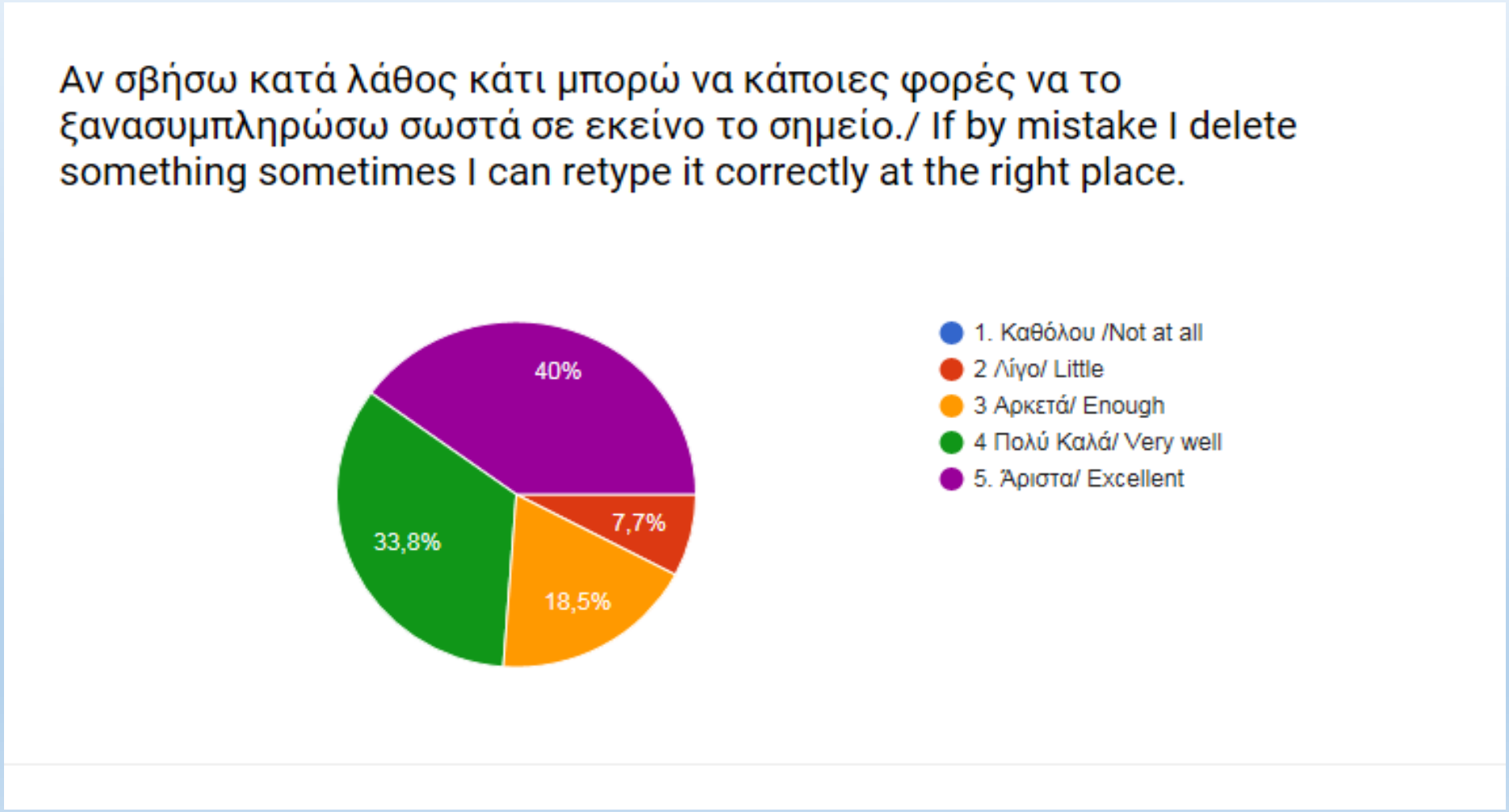
Self Evaluation: “I Understand how to move the direction of the initial side of the polygon.” 84,4% answered from Enough to Excellent.



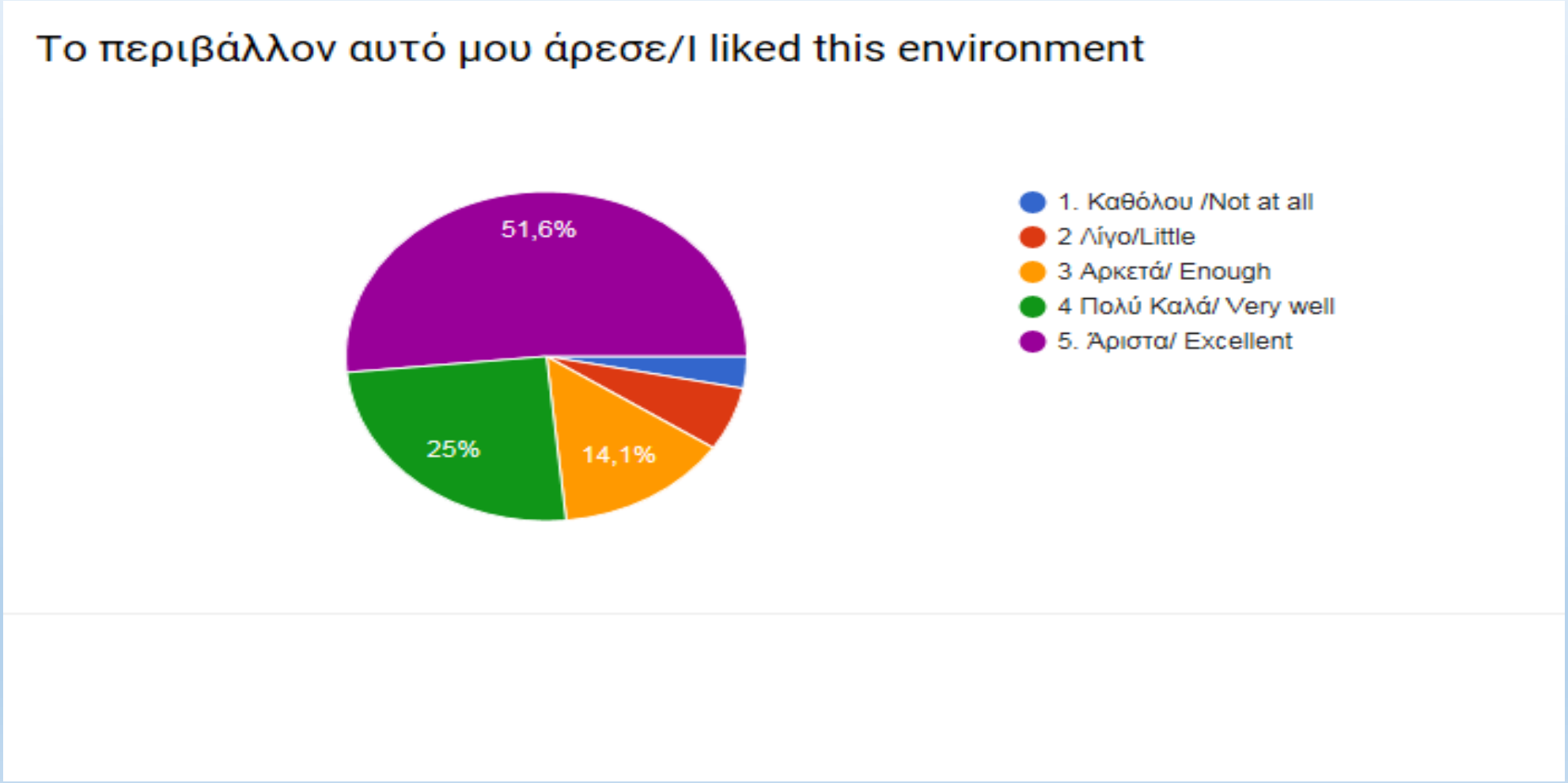
JS-Eden Evalualuation:
“I Understand when I delete something by mistake.” 86,1% answered from Very Well to Excellent



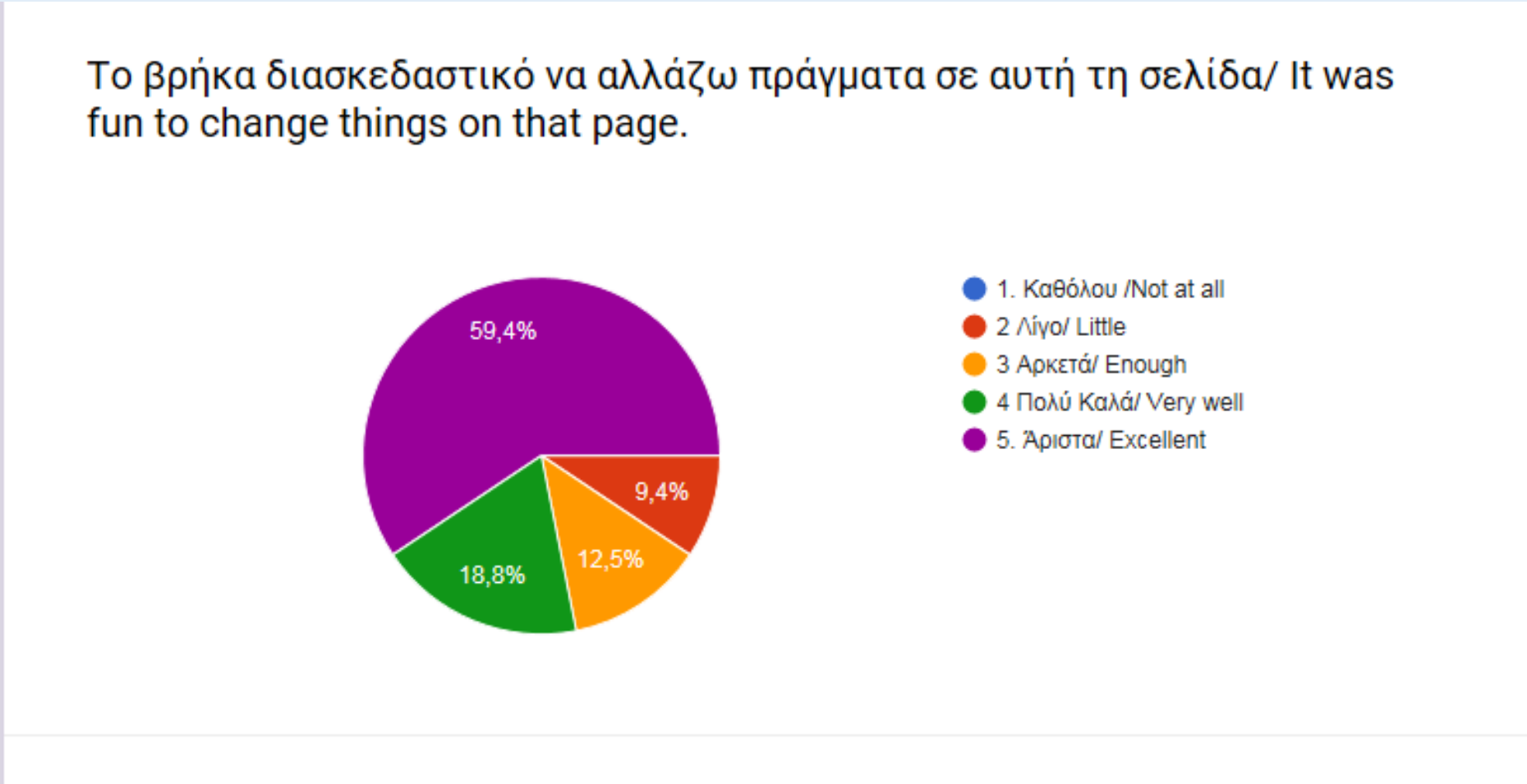
JS-Eden Evalualuation:
“I’m able to correct the code that I deleted by mistake.” 73,3% answered from Very Well to Excellent.



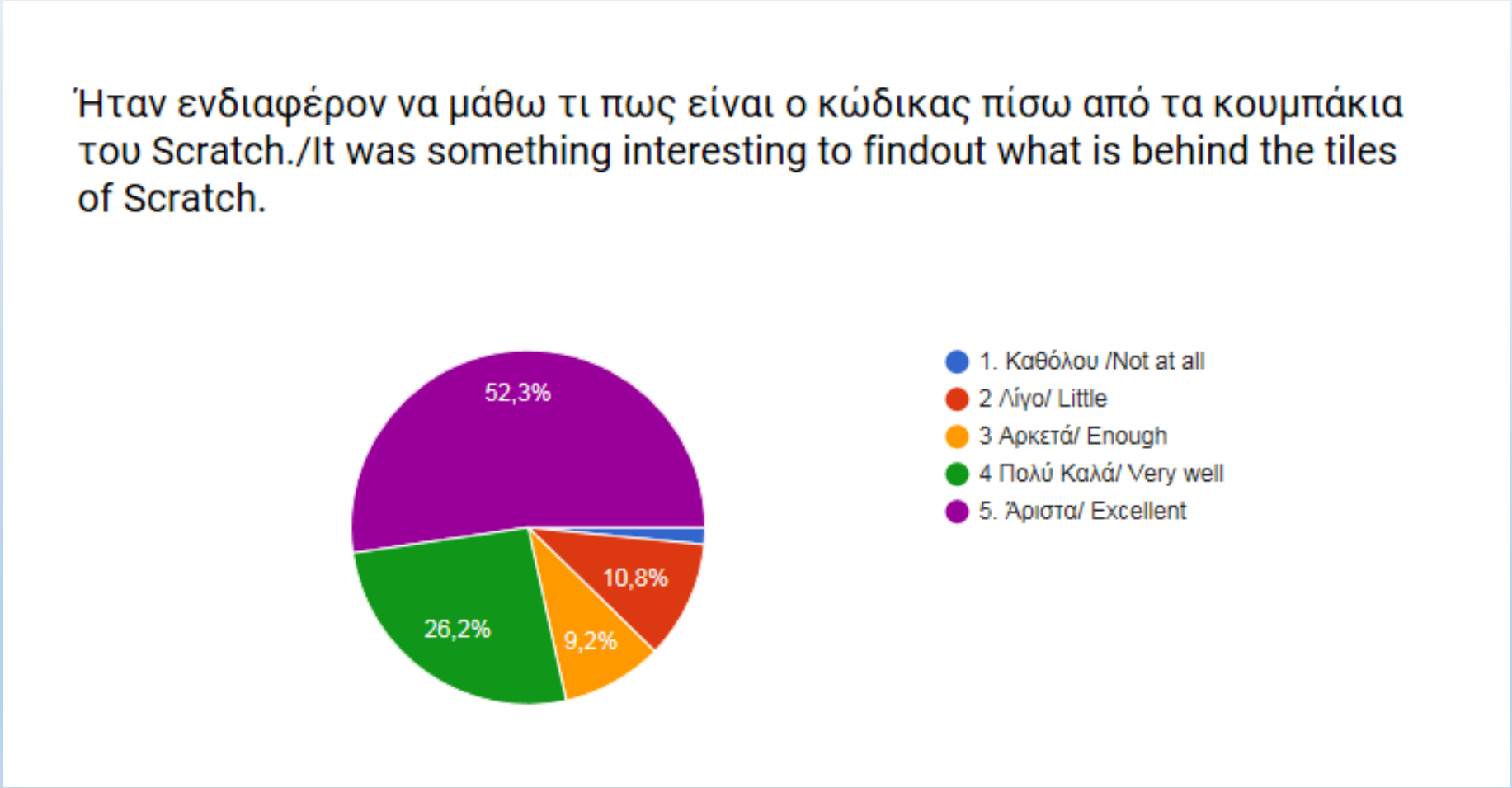
JS-Eden Evalualuation:
“I liked this Environment” 76,6% answered from Very Well to Excellent



JS-Eden Evalualuation: The statemend that it was fun changing things on JS-eden environment Polygon Construal expressed the opinion of the 78% of the sample from very well to Excellent



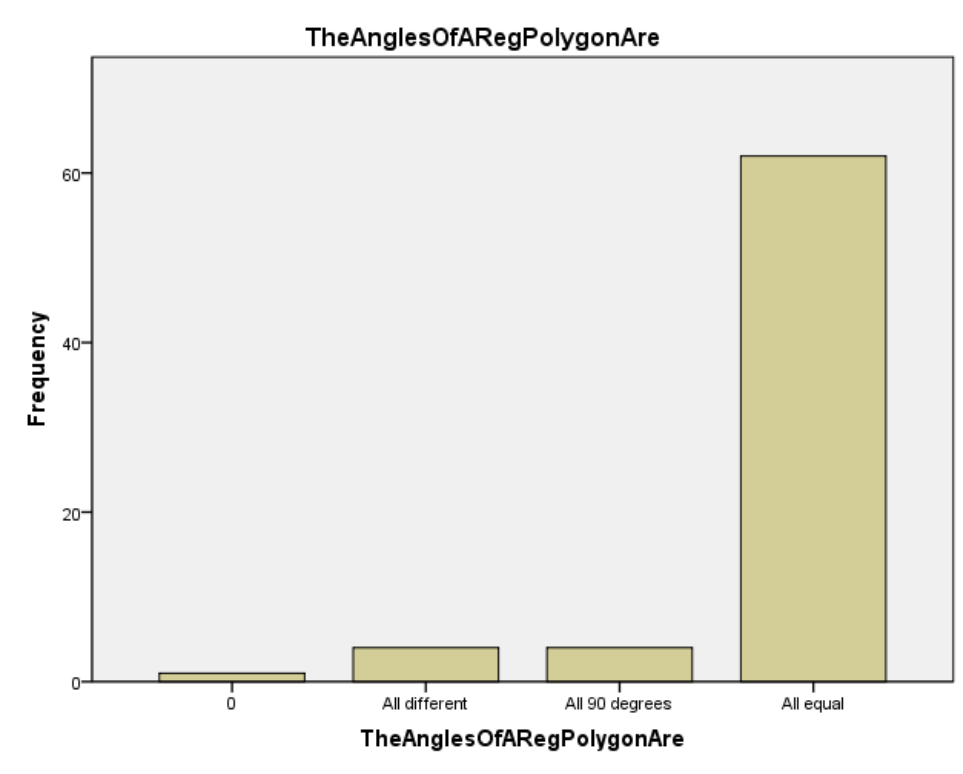
JS-Eden Evalualuation: The statemend that it was interesting to see coding on JS-eden environment Polygon Construal expressed the opinion of the 78, 5% of the sample from very well to Excellent.



Learning Outcome Evaluation: Multiple Choice Test

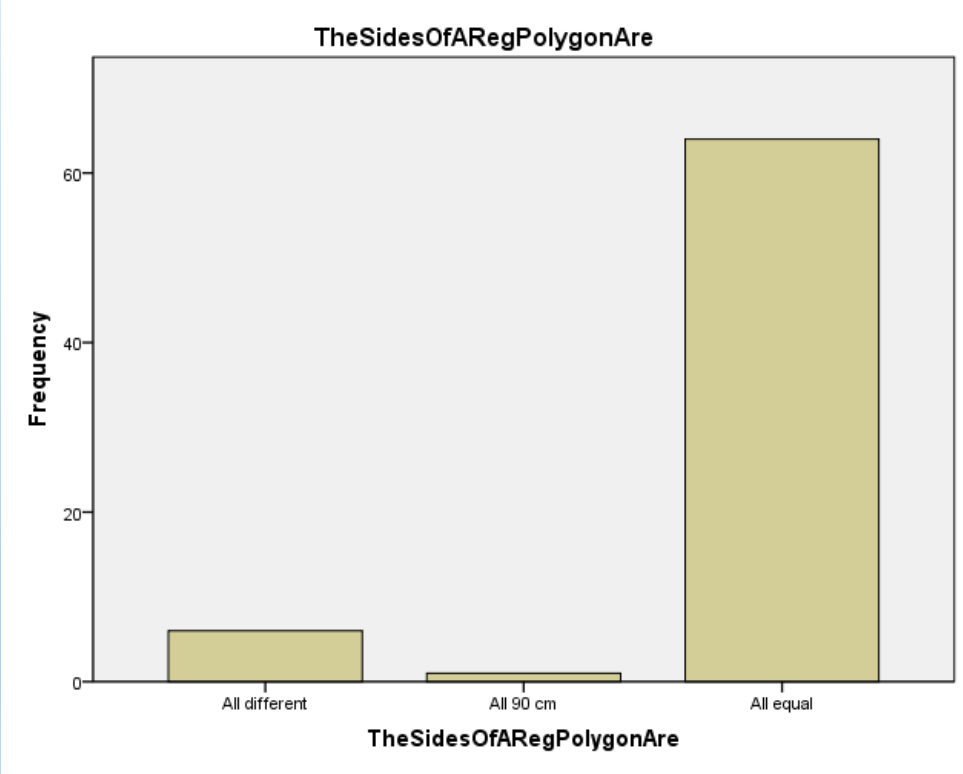
The angles of a regular polygon are:

87,3% All angles of Reg Polygon are Equal



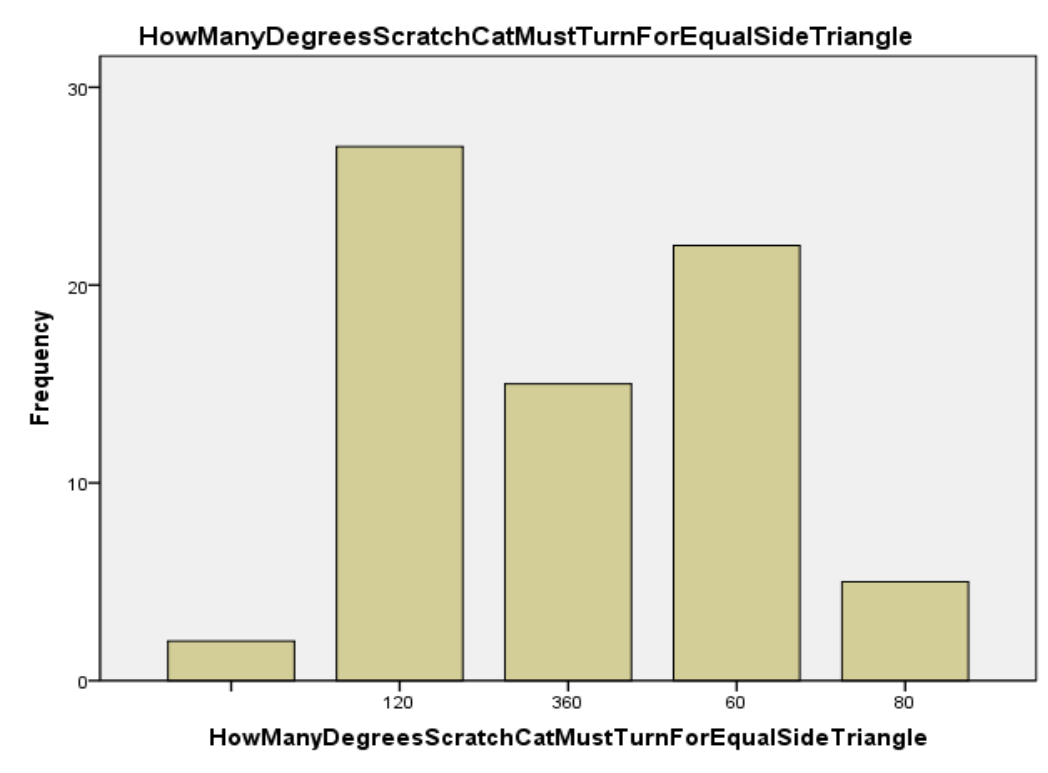
The sides of a regular polygon are:

90,1% All sides of Reg Polygon are Equal



Teaching needs depth of time

3 Classes Sample



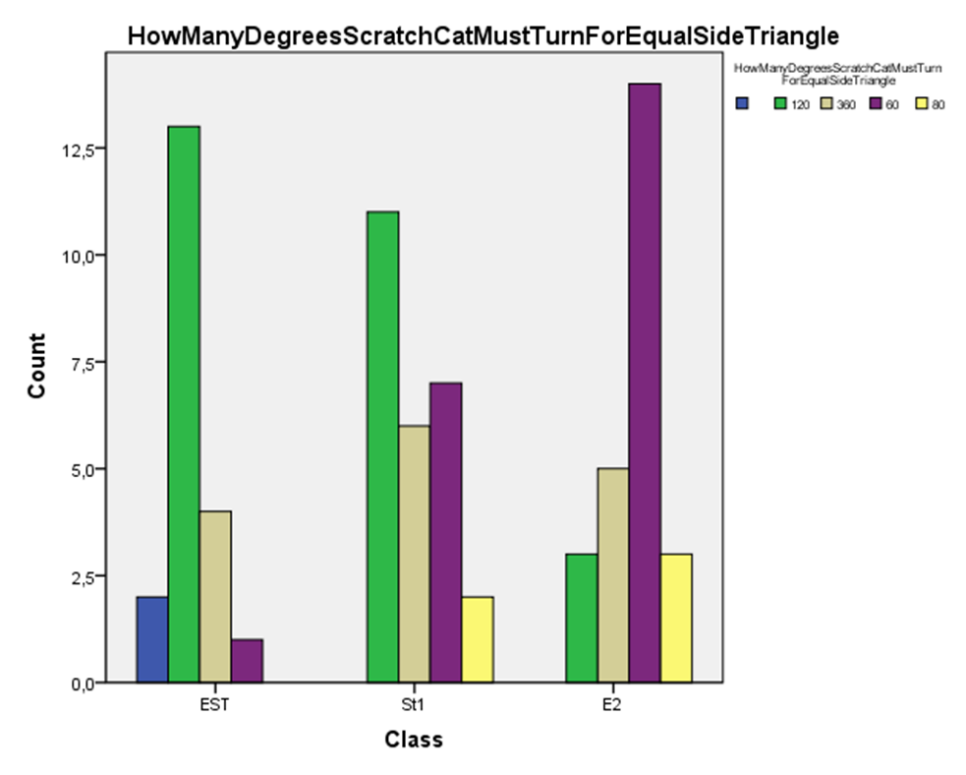
How many degrees the Scratch Sprite must turn in order to draw a Regular Triangle

- 35% answered correctly 120.
- 28% answered 60.
- 20% answered 360…

Looking closely…

Answers/Class

CrossTabs a=0.001

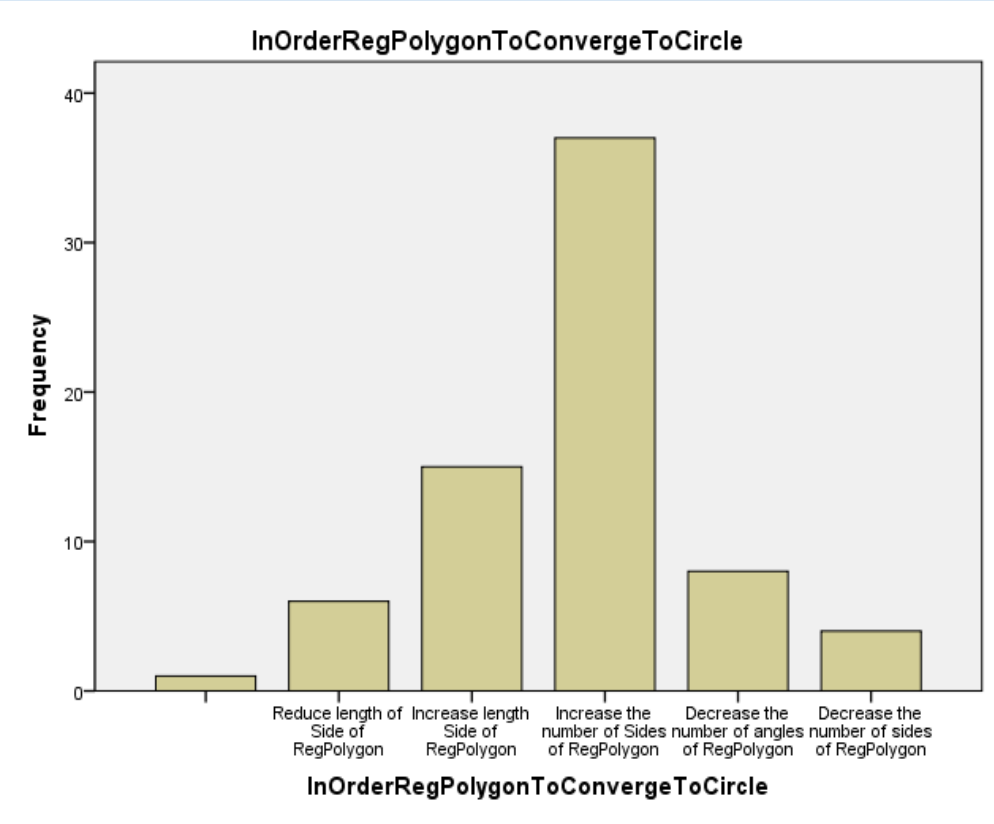


What was different?

- Means of math grades were equal in all three classes.
- 3-45’ lessons took place in all three classes.
- Same ICT teacher.
- Same Lesson Plan.
- <u>Duration of project:</u>
  - EST: One month.
  - E2: 10 days.
  - St1: 10 days

Teaching needs depth of time…

All Sample



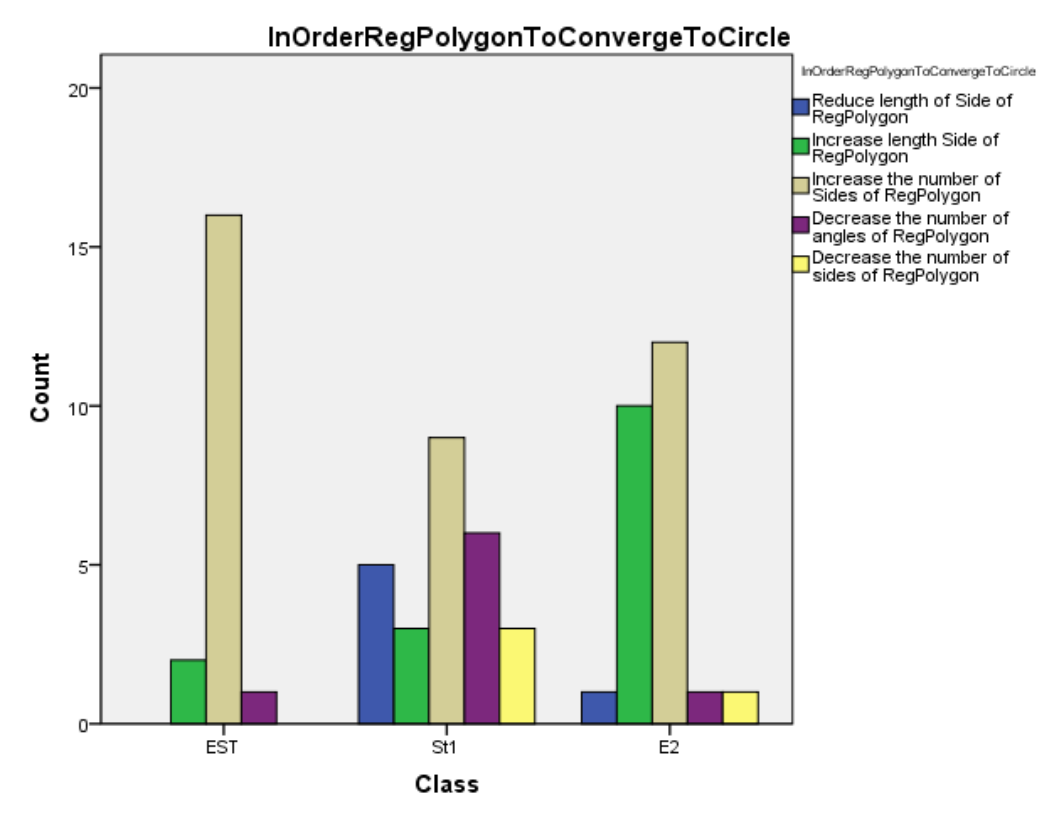
In order a polygon to converge to a circle:

- 50% Increase the number of sides
- 21% Increase the length of the sides
- 13% Decrease the number of angles

Looking closely..

Answers/Class

CrossTabs a=0.002



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Conclusions

- Pupils are usually confused on the degrees of interior angle of the Regular Polygon and degrees that the Scratch Sprite has to turn (supplementary).
- Pupils could spot what was deleted from the construal.
- Sometimes they could actually correct it-retype it.
- Pupils of 6th grade point the fact that in order the center for the Regular Polygon to be defined, the number of degrees should not be under 360.
- Few pupils observed the fact that the center could still be defined on the canvas if the degrees were above 360 depending on the number of angles of the polygon (if they were divisor of the degrees)
- In some cases they actually moved the Regular Polygon around the canvas not by changing the starting point but by changing the type of the calculation of the center as they had unlimited permission to change whatever they liked..
- Research is to be continued.

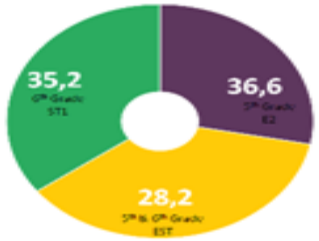
Acknowlegement

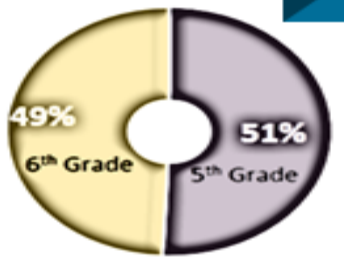
I would like to express my thanks to Prof. Steve Russ, Nicolas Pope, Elisabeth Hudnott and all the members of Construit! Team who worked and help this research to be implemented. Last but not least, I would like to thank prof. Meurig Beynon who introduced me to Empirical Modeling and who implemented the Regular Polygon Construal for this project.

REGULAR POLYGONS CONSTRUAL

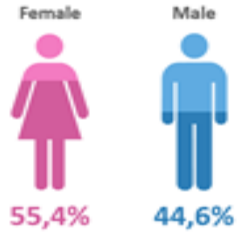
FROM SCRATCH TO CODING WITH JS-EDEN

3 Classes 5th & 6th grade

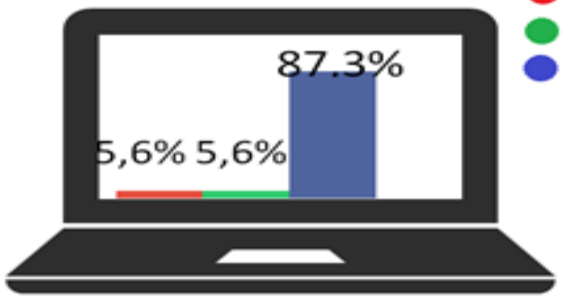




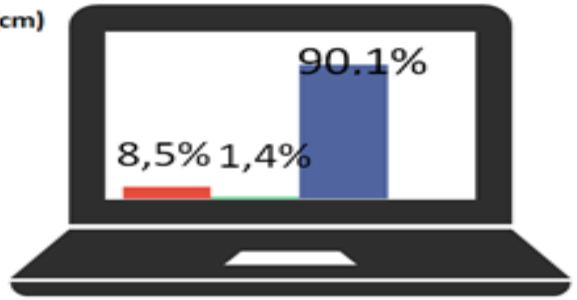
Test on Regular Polygons Construal



Angles are:

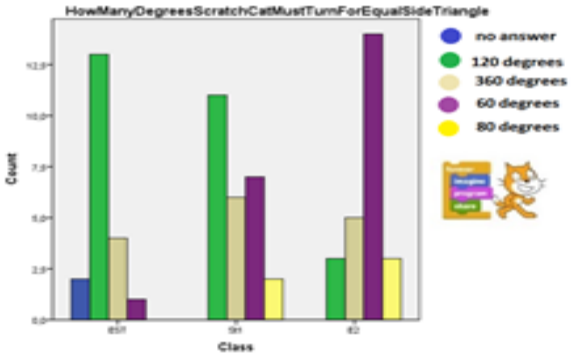


Sides are:

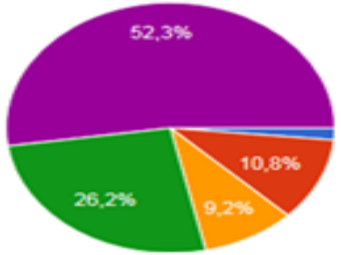


JS-Eden Evaluation: 78% Interesting & fun!

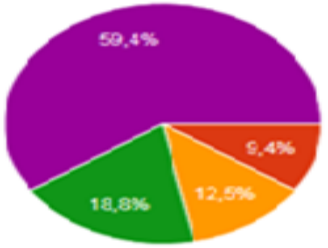
From Very Well to Excellent



It was interesting to change things on that page

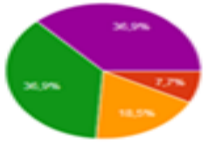


It was fun to change things on that page



Self-Evaluation on Regular Polygons Construal

I understand how to change the number of angles



Excellent
Very Well
Enough
Little
Not at all

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- https://ralleiapliroforiki.blogspot.gr/2017/05/blog-post_17.html
- http://jseden.dcs.warwick.ac.uk/construit/?load=210

CONSTRUIT 2017 Conference 13-16 July 2017