

Teaching and Learning Using Foss AI Driven Platform Geogebra To Improve Spatial Ability of the Students in Some Locus of a Points Related Problems in the Higher Classes

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Theme: “Reviewing the Best Practices and Recourses of Artificial Intelligence used in the Field of Education and Higher Education Sector”

Objective: Teaching And Learning Using Foss AI Driven Platform GeoGebra To Improve Spatial Ability Of The Students In Some Locus Of A Points Related Problems In The Higher Classes.

Abstract: Artificial Intelligence is significantly transforming different areas of life. In the Education, Medicine, Engineering, economy, commerce and industry, AI-driven automation is changing manufacturing, supply chain management, and customer service, boosting efficiency and innovation. Technology use and Integration give a pathway for the students and teachers to make digitally empowered society and knowledge economy around the globe and the integration of ICT makes education, accessible to people in remote areas of the country. Competency-based learning is an outcome-based approach to education to ensure proficiency in learning by students through demonstration of the knowledge, skills, values, assessment and evaluation and attitudes required for dealing with real life situations at the appropriate age and class level. Adaptive learning technologies are the educational technologies that use artificial intelligence (AI), machine learning (ML), image processing, data analytics, Flow charts and algorithms, mathematical concepts such as linear algebra, statistical analysis, Neural Network and fuzzy logic, to adapt the needs, abilities, assess student performance, learning styles and, identify knowledge gaps of each student, and to help students achieve their learning goals. GeoGebra is an AI driven platform for teaching and learning mathematics in schools. In this paper we will discuss teaching and learning using Foss AI driven platform GeoGebra to improve spatial ability of the students in some locus of a points related problems in the higher classes.

Keywords: Competency-Based Learning, Artificial Intelligence, Geogebra, Mathematics, Spatial Ability, Adaptive Learning and Locus Of A Points.

I. INTRODUCTION

1.1 Teaching and Learning of Mathematics:

Today there has been increased emphasis on meaningful learning and . Competency-based learning Especially in learning mathematics at the Higher stage, a change focused in school curriculum is a shift from content-based learning in to competency-based learning. It is important to note that these interactions in the classrooms do not emerge at once. A democratic atmosphere needs to be created. Such an atmosphere may encourage students to participate in discussions, ask questions, seek clarifications, challenge others' answers. The second change that is envisaged in connection with the first one is the mathematical focus in the classroom. Students need to engage in rich mathematical communication in the classrooms. [1,2, 4,5,6,7,8,9,10,12,13]

1.2. GeoGebra:

GeoGebra is indeed an AI-powered tool, its AI capabilities are allows users to create interactive mathematical models, graphs, problem-solving and simulations using a variety of tools .GeoGebra is dynamic mathematics software for all levels of education that contributes together geometry, algebra, spreadsheets, graphing, statistics, and calculus in one easy-to-use package. GeoGebra has become the leading provider of dynamic mathematics software which is suitable for Science, Technology, Engineering, and Mathematics (STEM) education and innovations in teaching and learning worldwide [1,2,5,6,8,9,10,11,12,13].. GeoGebra Classic 5 and 6 can be downloaded from the website www.geogebra.org. . The online community of GeoGebra is an excellent example of collaborative learning as the GeoGebra applet used by others is available for viewing, analysing, and modifying. [1,2, 4,5,6,7,8,9,10,12,13]. The strength of GeoGebra lies in

its generalizability through dynamism and visualization with practical approach. GeoGebra can include a practical contribution to mathematics education with proves a reality that computer-based classroom activities can be effectively used in the teaching and learning environment.

II. METHODS AND DISCUSSION

2.1 Methods and Discussion:

In the higher classes, the subjects like mathematics, business mathematics, statistics cover topics like Matrices and determinants, complex numbers, trigonometric and inverse trigonometric functions ,two dimensional analytical geometry, vector algebra, differential calculus ,differentials, partial derivatives, integration ,differential equations ,probability, statistics and discrete mathematics which have lot of practical applications in day to day life. The focus on competency-based education, emphasizing developing skills and competencies rather than mere knowledge acquisition. It could include a focus on critical thinking, creativity, communication, and problem-solving skills. In GeoGebra tools like polygon tools, measurement tools, conic tools, slider tool, input box, button box, text box, and interfaces, spreadsheet, probability calculator ,3D and 2D graphics helps to visualize mathematical concepts, relate them day to day life and develop critical thinking, creativity, communication, and problem-solving skills. Spatial ability refers to the capacity to understand, reason, and remember the spatial relations among objects and this skill enables students to visualize and manipulate shapes, geometric properties, and interpret graphical data. Strong spatial skills are linked to better performance in areas such as geometry, calculus, measurement, and problem-solving. GeoGebra is an interactive mathematics software that integrates geometry, algebra, and calculus, serving as a valuable tool for enhancing students' spatial abilities. By enabling dynamic manipulation and visualization of geometric figures, GeoGebra helps students develop a deeper understanding of spatial relationships and geometric concepts. It has demonstrated the effectiveness of GeoGebra in improving spatial skills. GeoGebra's 3D capabilities, including augmented reality features, offer innovative approaches to teaching spatial reasoning. Interactive modules, such as Developing Spatial Awareness Using GeoGebra 3D with AR, provide students with hands-on experiences that foster spatial visualization skills. It is very difficult to show with simulation of locus of points problems such as cycloid, perpendicular bisector, cardioid through traditional blackboard. Here we listing some GeoGebra activity of Locus problems which develops competency among the students. Concept with Link and QR code which develop Skill Development, Application, Real life Application. [1,2, 4,5,6,7,8,9,10,12,13]

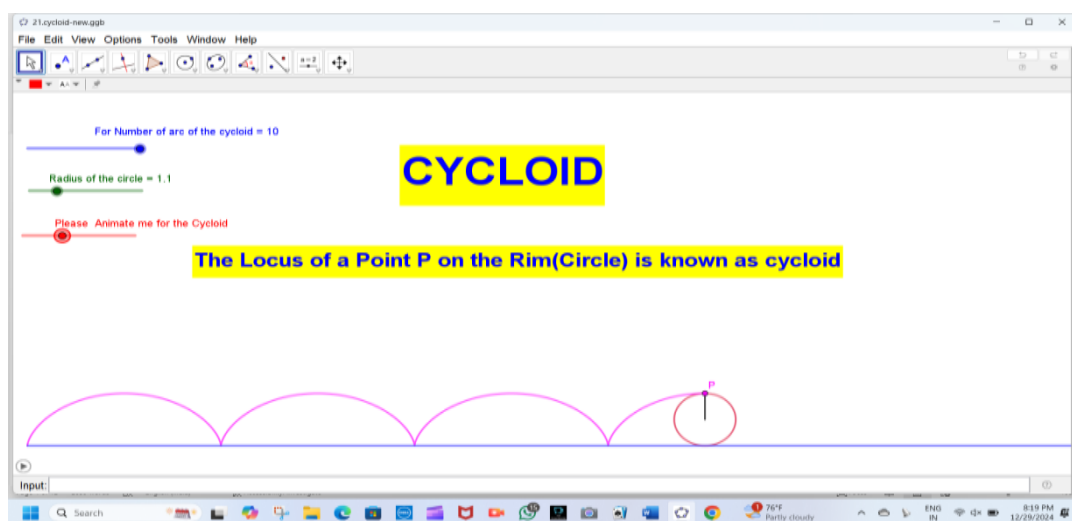
Activities:2.2:

ACTIVITY2.2.1: Cycloid:A cycloid is a mathematical curve that is generated by the motion of a point on a circle as it rolls along a straight line. It is a type of curve that is commonly studied in mathematics and physics, and has many interesting properties and applications.

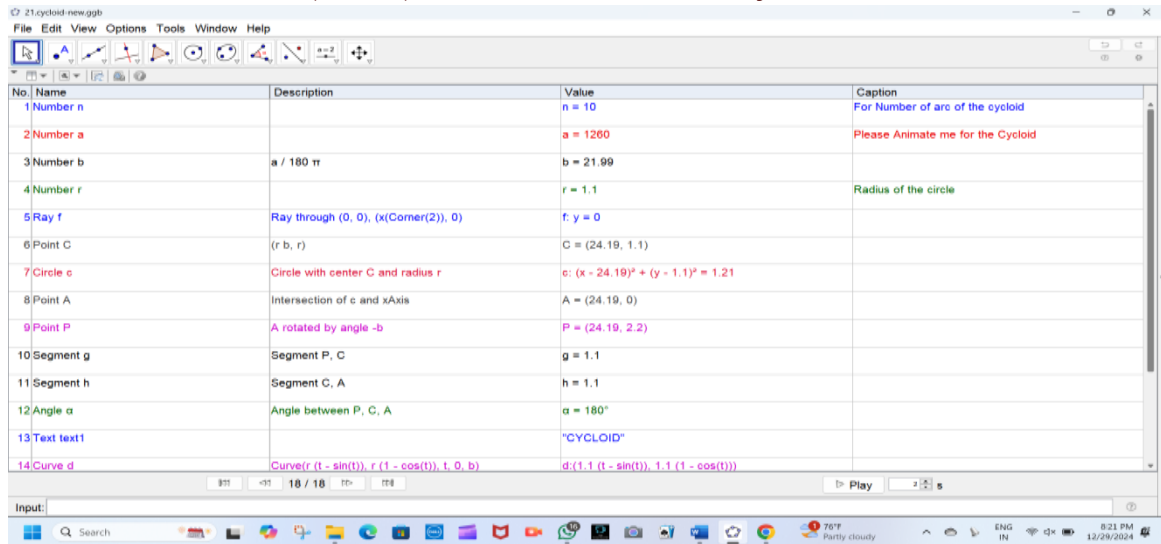
- 1) Concept : Cycloid
- 2) Skill Development : Critical thinking, creativity
- 3) Application :Engineering, civil and Mechanical
- 4) Real life Application :Engineering,Autocad,Robotics
- 5) Link : <https://www.geogebra.org/m/nfqtpkmk>
- 6) QR-code :



7) Activity:



8) Construction Protocol:



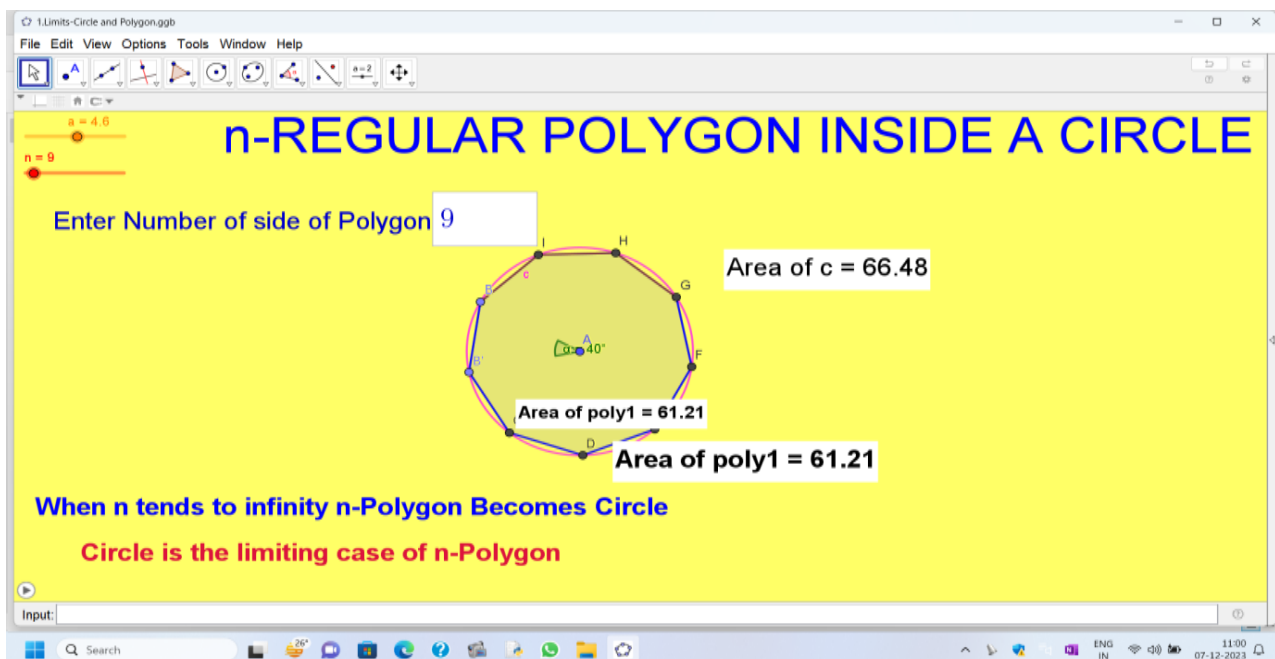
No.	Name	Description	Value	Caption
1	Number n		$n = 10$	For Number of arc of the cycloid
2	Number a		$a = 1260$	Please Animate me for the Cycloid
3	Number b	$a / 180 \pi$	$b = 21.99$	
4	Number r		$r = 1.1$	Radius of the circle
5	Ray f	Ray through (0, 0), (x(Corner(2)), 0)	$f: y = 0$	
6	Point C	(r b, r)	$C = (24.19, 1.1)$	
7	Circle c	Circle with center C and radius r	$c: (x - 24.19)^2 + (y - 1.1)^2 = 1.21$	
8	Point A	Intersection of c and xAxis	$A = (24.19, 0)$	
9	Point P	A rotated by angle -b	$P = (24.19, 2.2)$	
10	Segment g	Segment P, C	$g = 1.1$	
11	Segment h	Segment C, A	$h = 1.1$	
12	Angle α	Angle between P, C, A	$\alpha = 180^\circ$	
13	Text text1		"CYCLOID"	
14	Curve d	Curve(r (t - sin(t)), r (1 - cos(t)), t, 0, b)	$d: (1.1 (t - \sin(t)), 1.1 (1 - \cos(t)))$	

ACTIVITY2.2. 2: n-Polygon inside a Circle:

- 1)Concept : n-Polygon inside a Circle
- 2)Skill Development : Critical thinking, creativity
- 3)Application : Engineering, civil and Mechanical
- 4)Real life Application : limit
- 5) Link : <https://www.geogebra.org/m/vwjbya6u>



- 6)QR-code :

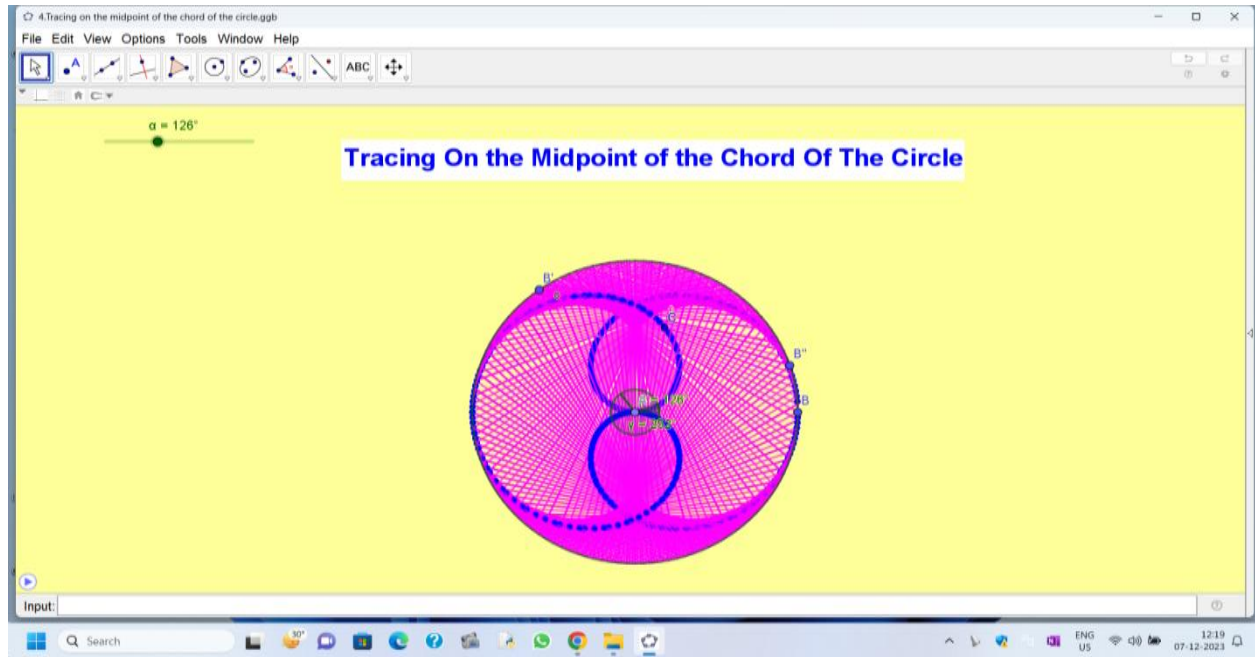


ACTIVITY 2.2.3: Tracing on Midpoint of the Circle :

- 1) Concept : Midpoint of the Circle Circle
- 2) Skill Development : Critical thinking, creativity
- 3) Application : Engineering, civil, Textile Design
- 4) Real life Application : Designing
- 5) Link : <https://www.geogebra.org/m/ee2mcwf8>



6) QR-code



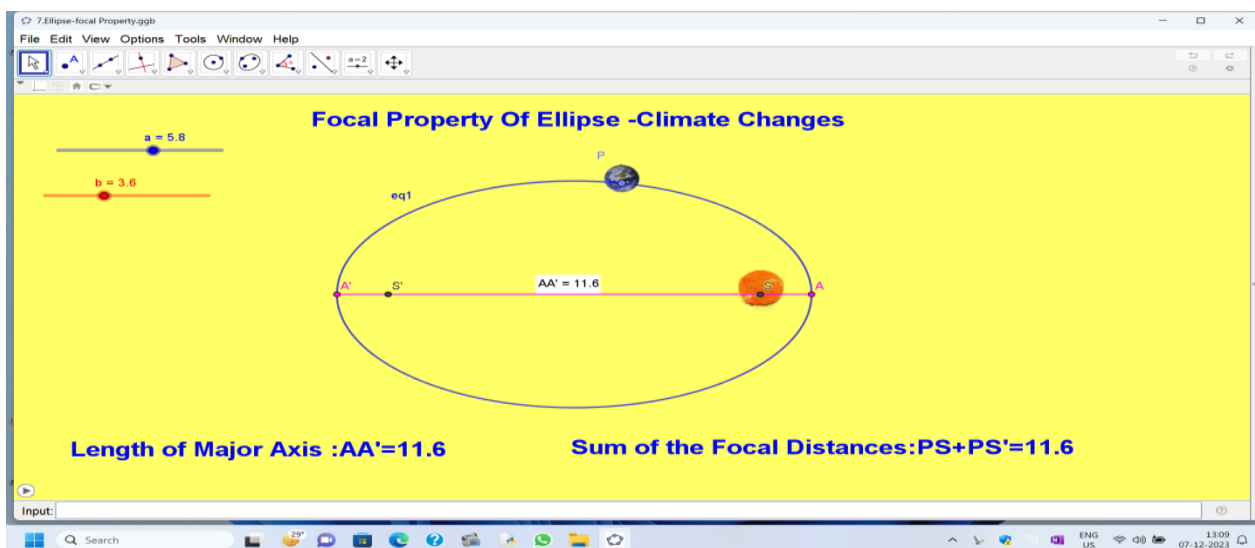
ACTIVITY 2.1.4: Focal Property of Ellipse:

- 1) Concept : Focal Property of Ellipse
- 2) Skill Development : Critical thinking, creativity
- 3) Application : Engineering, Climate Changes, Space.
- 4) Real life Application : Climate Changes
- 5) Link : <https://www.geogebra.org/m/rzhzajkw>



6) QR-code

7) Activity:



CONCLUSION

GeoGebra is software combines many aspects of different mathematical packages and ideas. In addition, because of its open-source nature, an extensive user community has developed around it. Mathematics teachers are encouraged to use AI technology in teaching and learning of mathematics in the school curriculum, as it allows teachers to convey their teaching ideas according to mathematical concepts. Simulations of Locus of Points cannot be shown by the traditional block board but same thing can be

shown by GeoGebra as like above activities applets. Hence, we conclude that in teaching and learning, the FOSS AI driven platform GeoGebra helps to improve spatial ability of the students in locus of a points related problems in the higher classes..

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