ANALYSIS OF VAN HIELE'S THEORY IN CIRCLE GEOMETRY: A FOCUS IN FET LEVEL

Sibawu Witness Siyepu
Cape Peninsula University of Technology

TARGET AUDIENCE: FET teachers and subject advisors

DURATION: 2 hours' workshop

MAXIMUM NUMBER OF PARTICIPANTS: 30 participants.

MOTIVATION FOR THE WORKSHOP

Geometry had been known as a problematic section of mathematics especial in South Africa with the teaching approach dominated by teacher tells. This workshop demonstrates the use of van Hiele's theory to enhance teachers' understanding of inductive approach as adopted from Micheal Serra. It is a hands-on enquiry leading participants to   develop investigative approach in their teaching of geometry.

DESCRIPTION OF CONTENT OF WORKSHOP

Participants will draw a circle and explore the following concepts he following concepts. 30 minutes

- Radius
- Centre
- Diameter
- Sector
- Annulus
- Secant
- Segment
- Chord
- Tangent
- Arc
- Circumference

Level 2 (Analysis): 30 minutes: Students see figures as collections of properties. They can recognize and name properties of geometric figures, but they do not see relationships between these properties. When describing an object, a student operating at this level might list all the properties the student knows, but not discern which properties are necessary and which are sufficient to describe the object.

Activity 2. Given an economic definition of each concept mentioned in activity 1 above.

The following is a recap of terms that are regularly used when referring to circles.

- Arc: An arc is a part of the circumference of a circle.
- Chord: A chord is a straight line joining the ends of an arc.
- Radius: A radius, r, is any straight line from the centre of the circle to a point on the circumference.
- Diameter: A diameter is a special chord that passes through the centre of the circle. A diameter is the length of a straight line segment from one point on the circumference to another point on the circumference that passes through the centre of the circle.
- Segment: A segment is the part of the circle that is cut off by a chord. A chord divides a circle into two segments.

- Tangent: A tangent is a line that makes contact with a circle at one point on the circumference.

Level 3 (Abstraction): Students perceive relationships between properties and between figures. At this level, students can create meaningful definitions and give informal arguments to justify their reasoning. Logical implications and class inclusions, such as squares being a type of rectangle, are understood. The role and significance of formal deduction, however, is not understood.

Tangent to a Circle: 50 minutes

Draw a tangent to the circle and join the point of tangency with a radius.

Then make a conjecture; what is the relationship between a tangent and a radius of the same circle.

Step 1. Construct a circle with a 4cm radius.

Step 2. Select two points on the circle. Label them A and B.

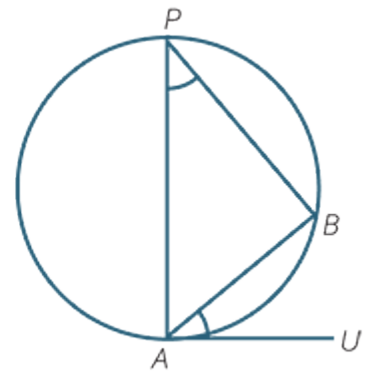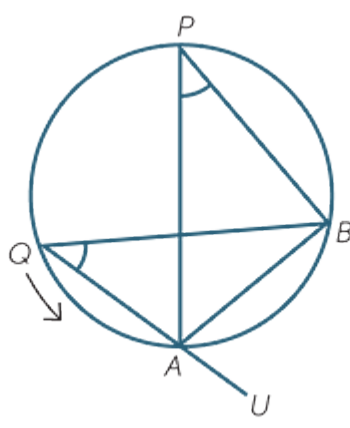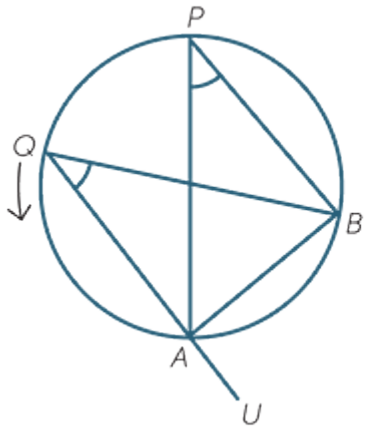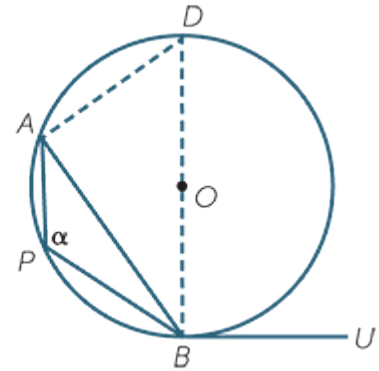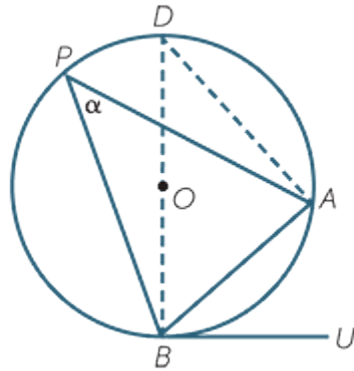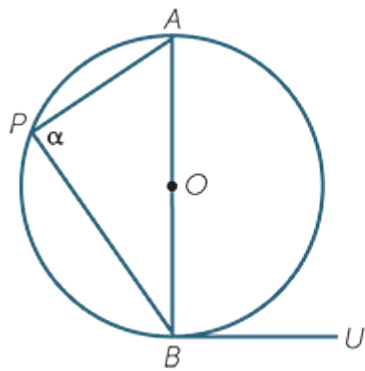Step 3. Select a point P on the major arc and construct inscribed $\angle APB.$

Step 4. With your protractor, measure $\angle APB.$

Step 5. Select another point Q on the arc APB and construct inscribed $\angle AQB.$

Step 6. Measure $\angle AOB$. How does the measure of $\angle AQB$ compare with the measure of $\angle APB.$

Step 7. Make a conjecture.

Use the diagrams below to determine the relationship of angles that are equal.

Level 4 (Deduction): Students can construct proofs, understand the role of axioms and definitions, and know the meaning of necessary and sufficient conditions. At this level, students should be able to construct proofs such as those typically found in a high school geometry class.

Wrapping up: 10 minutes

Evaluation of the workshop:

What went well?

What was good?

What can be done differently next time?

Over-view