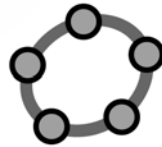




中學數學電子學習系列：(2) 在數學課堂有效運用資訊科技 (進階程度) (修訂)

教育局數學教育組

2018年4-5月



GeoGebra 簡介

- GeoGebra 是一套結合幾何(平面+立體)、代數、統計及微積分等的免費動態幾何軟件，它是在 2001 年由 Markus Hohenwarter 在奧地利的 Salzburg 薩爾茨堡大學所設計。
 - GeoGebra 其實就是他的碩士論文。
 - 目前在奧地利 Linz 的 Johannes Kepler 大學(克卜勒大學)擔任數學教學研究所所長。
- GeoGebra 是由 Java 寫成的，因此可以跨平台使用。
- GeoGebra 的一些學與教用途：
 - 教師用於課堂演示互動幾何圖像；
 - 學生用於探索與發現幾何概念，猜想幾何定理。
- 2011: 38 developers & 200 translators Celebrating 10 years of GeoGebra



*If you want to go fast, go alone.
If you want to go far, go together.*

GeoGebra

最近版本： 6.0.453.0
 Stable release 6.0.452.0 (8 April 2018)
 Stable release: 6.0.410.0 (10 December 2017)
<https://en.wikipedia.org/wiki/GeoGebra>

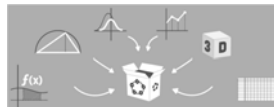
下載與安裝

- GeoGebra Desktop vs. Web and Tablet App
- 桌機版 vs 線上版或平板版



GeoGebra

- www.geogebra.org
- GeoGebra Augmented Reality (iOS Apps)



Discover Math with GeoGebra

Solve equations, graph functions, create constructions, analyze data, explore 3D math!

GeoGebra 繪圖計算機 GeoGebra Geometry GeoGebra 立體繪圖

檔案 GeoGebra Classic Downloads

Available on the App Store Get it on Google Play Windows Store

GeoGebra

THE GRAPHING CALCULATOR FOR FUNCTIONS, GEOMETRY, ALGEBRA, CALCULUS, STATISTICS AND 3D MATH!

老師與學生都可使用的動態數學工具

GeoGebra Augmented Reality (iOS Apps)

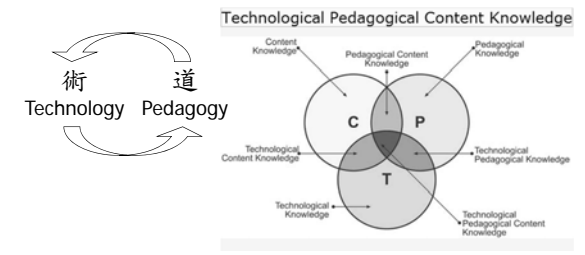
- GeoGebra Augmented Reality
 - By International GeoGebra Institute (IGI)
 - This app is only available on the App Store for iOS devices.



https://itunes.apple.com/app/geogebra-augmented-reality/id1276964610?utm_source=Download+page&utm_medium=Website&utm_campaign=GeoGebra+Augmented+Reality+for+iOS

TPACK

- Technological pedagogical and content knowledge (TPACK) refers to teachers integrating technology with pedagogy (teaching methods) and content.
- <https://julianaliebke.wordpress.com/literature-review/>



*How GeoGebra (and other IT tools)
may enrich classroom L&T?*

Mathematics Education Section

Advantages of GeoGebra

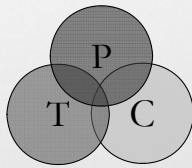
- Dynamic
- Extremely rich in functions
- Fast to observe and conclude

Disadvantages of GeoGebra

- Dynamic without knowing the mechanisms
- Too rich in functions without knowing the focus
- Too fast to observe and conclude only by superficial observations

Key question

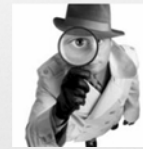
- What to teach?
- How to use?
- How to **refine**?



12

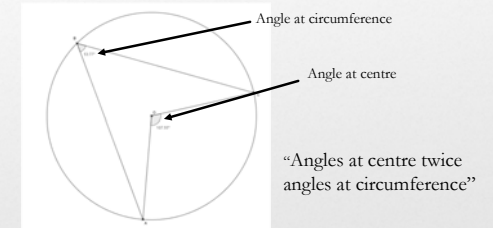
L&T in Properties of Circles

- A refinement process on L&T package using dynamic geometry software
- A theorem on the properties of circles



13

The theorem



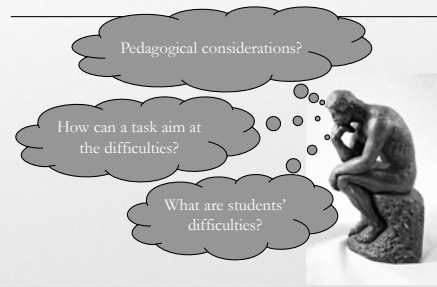
14

The proof



15

Does it work?



16

Refinement: From visualisation to abstraction

Understand the limitations

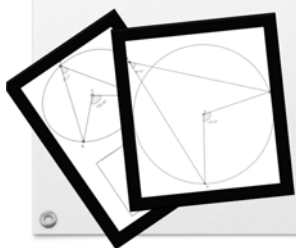


Dynamic geometry vs Euclidean Geometry?
Computation work vs Mind work

17

Refinement: From visualisation to abstraction

Stretch the potential



Re-reading a geometric theorem:
In a circle, an angle at any points of the circumference is half of the angle subtended by the same arc of the circle at the centre.

Conditions and consequences:
Pedagogy of variations

18

A complete cycle of teaching

- Examples versus verifications
- Counter-examples versus constraints

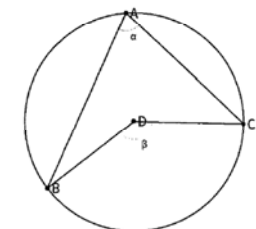
19

Re-visit the theorem: Think about it

Section D: Think about it

Question 2

Cody claims that if $\beta = 2\alpha$, D must be the centre of the circle. Do you agree? Explain your answer.



20