Virtual Reality and Augmented Reality Application in Classroom Teaching and Field Study

Dr. TAM Pui Yuk Tammy[1], Mr KWOK Chi Fai Eddie[2], Miss CHU Sau Yung[1], Mr WONG Tik Sun Dickson[1]

[a] Earth System Science Programme, Faculty of Science, The Chinese University of Hong Kong
[b] Centre for eLearning Innovation and Technology, The Chinese University of Hong Kong

Introduction

In the Earth System Science Programme, a field-based course is a significant hands-on practice for students. Understanding the physical properties of minerals is fundamental for field studies. Unluckily, junior students who participated in traditional lectures may quickly lose interest in understanding the critical features of minerals as some of the mineral characteristics are complicated and hard to imagine the 3-dimension skeleton.

Besides, the current workforce is insufficient to efficiently and effectively cater to the increasing number of students for field study. This situation affects the student's initiative of learning in the classroom and studied areas. Our team believes that incorporating traditional and online teaching materials into **Augment Reality (AR) supplemental learning kit** and **Virtual Reality (VR) tours** for learning minerals and pre-trip tutorials are possible means to assist students physically and mentally ready for the classroom and on-site study.

AR supplemental learning kit

Despite no current mineralogical course, and it takes time for junior students to understand mineral features, AR supplemental learning kit can instantly display the 3-dimensional mineral skeletons. It visualizes how molecular arrangement affects the physical properties (e.g., shape, hardness) of minerals.

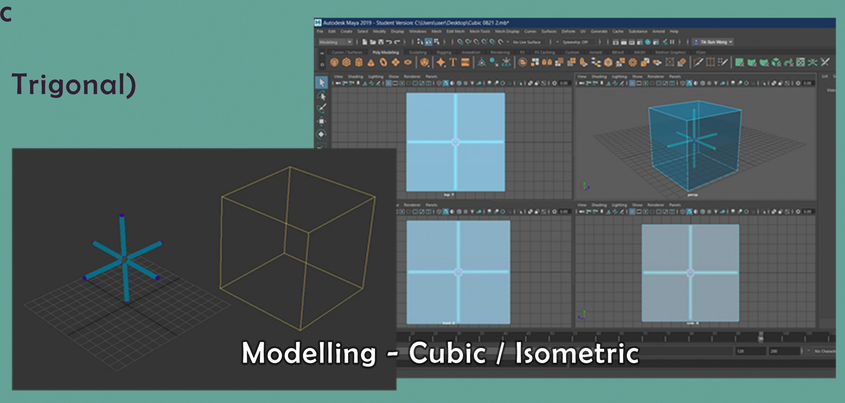
HOW it helps?

- Project the 3D molecular structures of minerals
  - Able to interact with the projection on mobile devices
- Help memorize the unique properties of minerals

→ Enhance field study, as well as classroom and laboratory learning

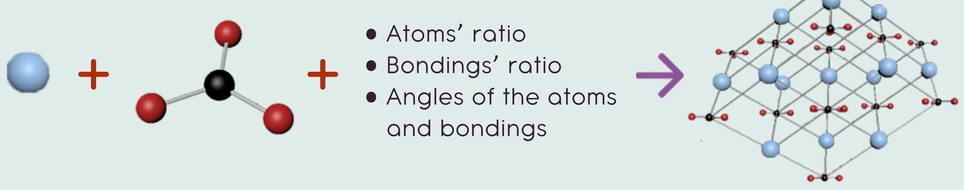
Showcase – Crystal forms and Mineral

- 6 crystal forms + corresponding mineral examples:
  - Cubic / Isometric
  - Hexagonal (Rhombohedral, Trigonal)
  - Tetragonal
  - Orthorhombic
  - Monoclinic
  - Triclinic



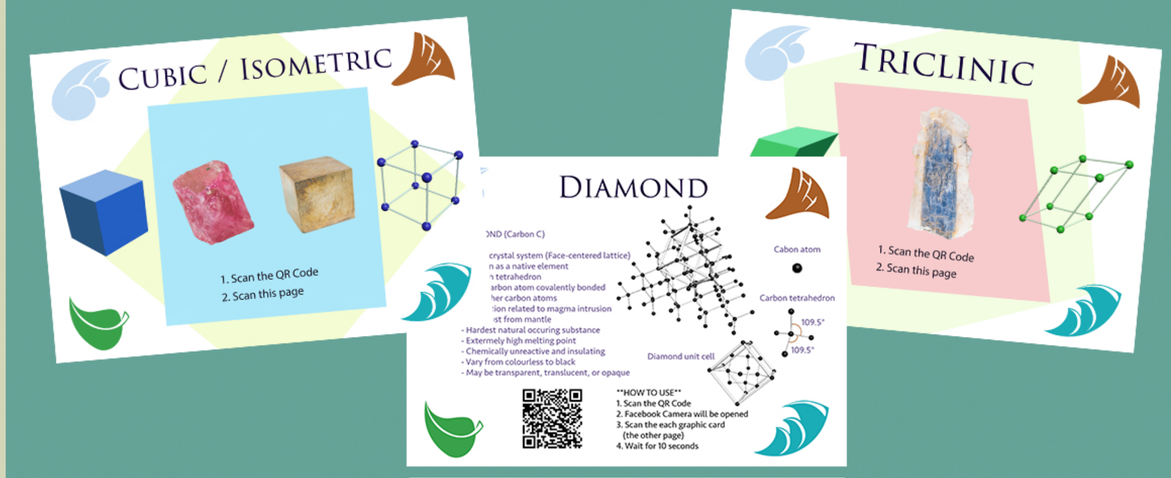
- Structures of some common minerals
  - Calcite, Diamond, Graphite, Sodium chloride

Modelling - Calcite ($CaCO_3$)



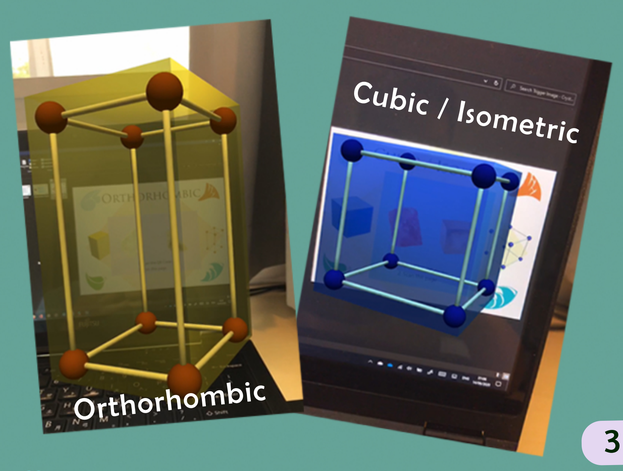
How to use?

1 Scan the trigger image



Description at the back of the card

2 3D structures shown on mobile phone



3 Use fingers to move/scale/rotate

Future development

- Specific mineral group structures
- Interactive classroom teaching: Games (using AR)
- Promoting science to the public

VR Tours

Field-based courses require intense preparation and fast learning pace in the field. Students have to gain adequate geology background and pre-trip practice. Applying advanced VR technology in classroom teaching does not only raise students' interest in learning geology via a new way; this also provides "real-scenes" of the studied areas for students to preview and review the geological features.

HOW it helps?

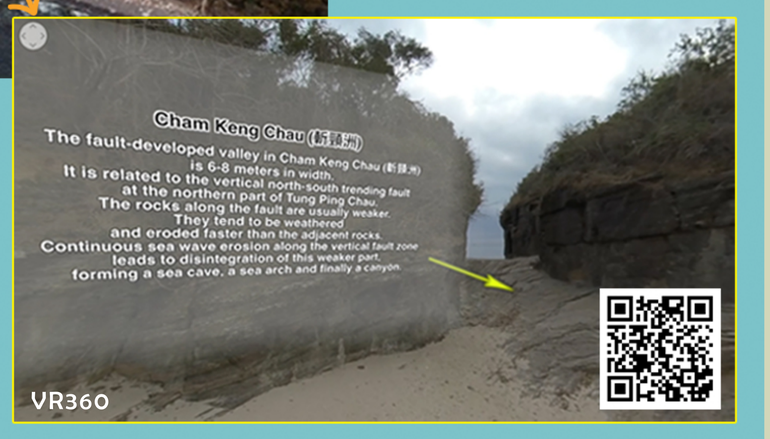
- Better 3D idea of the real field area
- Cartoons can explain the exact features instantly
- Always look back to the "real study area" for review
- Encourage students to get a quick preview and preparation for the field study
- More efficient way to teach and learn in the field

Showcase – Tung Ping Chau

(I) Two VR360 + Two Aerial videos

A full picture of the topographic feature at Cham Keng Chau that is difficult to see in the field can be viewed via aerial video.

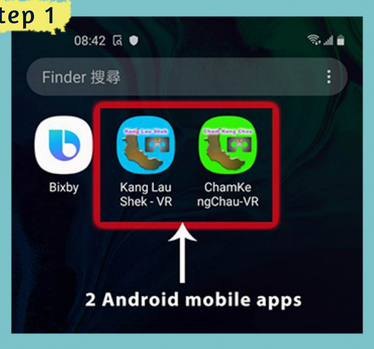
Detailed explanation about the geological characteristics at Cham Keng Chau in VR360 enhances both teaching and learning in the field.



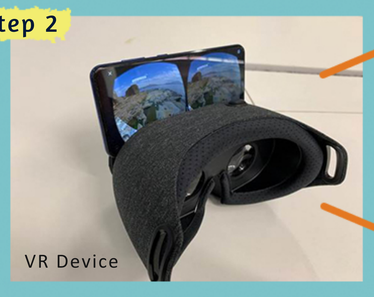
(II) Two mobile apps (Android) + VR Device

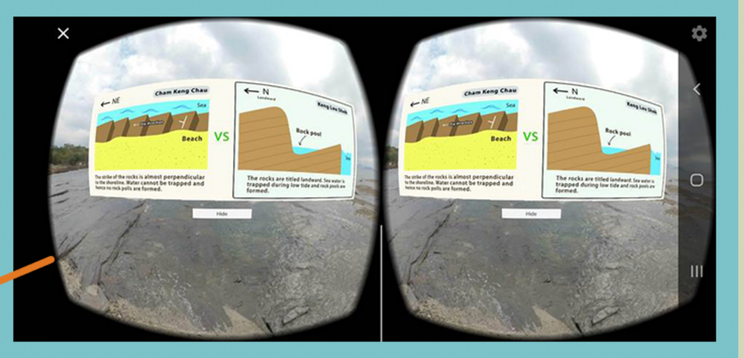
VR display with graphic explanation illustrates the "real-scenes" and the coastal erosion processes at various points of the studied area at Tung Ping Chau.

Step 1



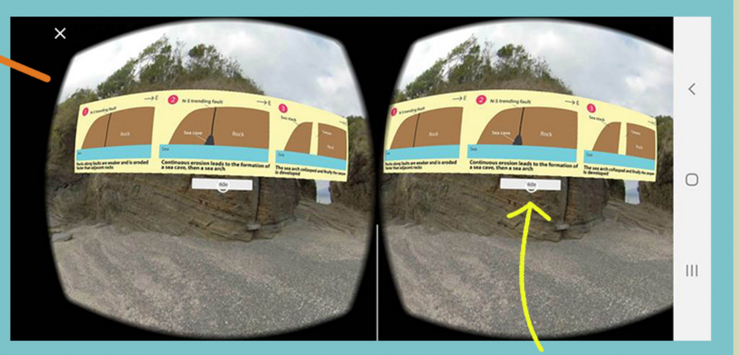
Step 2





Stereo 360 images shown on mobile phone

Step 3



Press the button to show/hide the cartoon

Feedback from students

- Get a better idea about a geologic field study
- Very useful for the field assignments

Future development

- Hong Kong/Taiwn field study areas
- Future collaboration with other departments or universities

Acknowledgement

Teaching Development and Language Enhancement (TDLEG) for 2016-2019 Triennium (project code: 4170605)