

A VR mobile application containing four micro-modules was produced for better teaching and learning in UGFN1000. The first two micro-modules allow students to visualize the relationship between the empirical observations of heavenly bodies from earth, and the model proposed by Aristotle. In the first module, students can see a VR 3D cosmology model of Aristotle, where various planets circle around the earth. In the second module, students can look at the rotating night sky from the viewpoint on earth. This enables them to appreciate the credibility of Aristotle's idea and the significance of the emergence of modern sun-centered model.

The remaining two micro-modules allow students to visualize the separation of motion into horizontal and vertical components. It shows the trajectories of cannon balls shot vertically upward from both a moving train and stationary train. Cannon balls can be shot at various power for students to observe the same phenomenon under different conditions. Students can also pause the 3D animation in order to observe the consistency between the vertical motion of the cannon balls shot from the stationary train and moving train. This helps them understand better Newton's Laws of Motion and appreciate the conceptual change in the explanation of projectile motion from Aristotle to Newton.

The micro-modules were used in the tutorial sessions of text 2 and 3, where students were provided with VR headset and used the VR mobile app together under the guidance of teacher. Approximately 500 students have engaged the app in UGFN1000 in 2018-19 T1. Survey has been designed to study to what extent the apps have improved their understanding of the concerned concepts. It has been taken by students who have not used the app (pre-test) and students who have used the app. Furthermore, the usage of this VR app can potentially be expanded to approximately 1800 students in around 75 UGFN1000 tutorial sessions per semester in the future.

In conclusion, we have successfully developed a VR mobile app for the improvement of learning and teaching in UGFN1000. The apps are successfully implemented in tutorial sessions. Evaluations with student surveys have also