

## Applying QR Tag and Augmented Reality to Differentiated Instruction

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### ABSTRACT

Augmented reality (AR) technology is widely utilized in education with virtual experience and interaction. Educators can enhance students' learning experience by incorporating virtual objects in real scenes/screens. The QR tag is commonly used in the marker-based AR system for the convenience of estimating the camera tracking and pose. When the camera captures the tag, the corresponding virtual object will appear on the QR tag with an appropriate location. However, the conventional AR system only shows the same virtual object in the education environment. That is, it treats all learners as the same role and generate the same content for all students. To promote learning experience and efficiency, classifying students in different levels become an important issue in the design of AR system. In this research, we designed a novel AR education system that can generate different virtual objects to meet the needs of different students with the same QR tag. Firstly, students can be classified into different groups according to their levels of learning. Each group will then receive a specific code. The proposed system thereby conceal all groups' codes into a QR tag by exploiting the error correction capability of QR code. The designed AR system can distinguish different groups from the same QR tag. General users can still see the normal virtual object upon the QR tag. On the contrary, specific students with the group code can derive the diverse virtual objects with the same QR tag. Therefore, this new system is practical and can be widely applied in different learning phases according to students' levels.

**Keywords:** augmented reality; QR code; education; learning experience; levels