Chapter VI
A User Acceptance Study on a Plant Mixed Reality System for Primary School Children

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ABSTRACT

Based on the initial findings of Study I (Theng, Lim, Liu, & Cheok, 2007) on our plant mixed reality system (PMRS), designed for primary school children (11-12 years old), this chapter describes Study II, employing the well-established technology acceptance model (TAM) to investigate participants' perceptions of usefulness and usability, identified as key determinants of participants' intention to use the system. Preliminary results seemed to indicate participants' intention to use the PMRS for learning, and this intention was influenced directly by perceived usefulness and indirectly through perceived usability and social influence. System quality, personal innovativeness, and compatibility were found to be important external factors. The chapter concludes with a discussion of implications on the design of mixed reality systems for education.

MIXED REALITY APPLICATIONS IN EDUCATION

Mixed reality (MXR), the incorporation of virtual computer graphics objects into a real three-dimensional scene, or alternatively the inclusion of real world elements into a virtual environment (Pan, Cheok, Yang, Zhu, & Shi, 2006) is one of the newest technologies explored in edutainment that promises the potential to revolutionise learn-

ing and teaching, making learners' experience more "engaging." But, history has shown that as new technologies evolve before maturing and succeeding in penetration and acceptance in our daily lives, there is a need to carry out empirical studies to understand users' perceptions of usability and usefulness of such technologies as early as possible to avoid expensive remedial work later (Mikropoulos, Chalkidis, Katsikis, & Emvalotis, 1998; Theng et al., 2007).

However, little known work has been done to understand students' acceptance of the mixed reality technologies for learning, and it is believed that formal investigation into the area of *acceptance* of mixed reality in the context of education could yield a better understanding of the criteria that are important to users, in this case, students, in using such technology for their learning.

Hence, in this chapter, we describe Study II, a follow-up investigation to Study I (Theng et al., 2007), being conducted to investigate initial students' perceptions of usefulness and usability of the system. In Study II, we applied a modified technology acceptance model (TAM) to understand the factors that may motivate/hinder the acceptance of the system. The chapter will also discuss the implications of the findings in relation to the design and implementation issues for PMRS, as well as mixed reality applications in general.

PLANT MIXED REALITY SYSTEM (PMRS)

In this section, we briefly revisit the development of PMRS so that their methods and findings can provide a background for the body of this chapter, and the issues explored within.

PMRS, developed by the Mixed Reality Lab of the National University of Singapore (NUS), was selected as a case study to understand users' perceptions of mixed reality systems since this is one of the first known educational mixed reality programs designed according to the local school syllabus and deployed in a local primary school (School X) in Singapore. It was designed for Primary Five students (11-12 years old), who were taught seed germination, plant reproduction, seed dispersion, and photosynthesis in their science lessons. The PMRS was developed together with a group of teachers from a primary school in Singapore. Physical objects were used in this project to give pupils the "tangible" experience. PMRS was designed to be suitable for the classroom environment and at same time for self-learning. By projecting the display on a big screen, a teacher can use this system as a general teaching tool. For self-learning, texts and sounds were added in this system to help students to better comprehend the contents. In addition, the MXR technology also aims to bring the entertainment elements to the learning process, allowing pupils to learn in a more interesting way.

Unlike immersive VR, the PMRS interfaces allow users to see the real world at the same time as virtual imagery attached to real locations and objects. In a PMRS interface, the user views the world through a hand-held or head-mounted display (HMD) through overlays of graphics on video of the surrounding environment. The most unique character of PMRS is that the interface allows people using physical objects to interact with virtual world in a tangible way. PMRS aims to provide totally different learners' experiences in education by:

- Supporting seamless interaction between real and virtual environments;
- Using a tangible interface metaphor for object manipulation; and
- Switching smoothly between reality and virtuality.

As shown in Figure 1, using a physical spade, pupils can add virtual soil in the real flower pots. They can also add virtual seeds using spade and add virtual water using watering can. By pressing

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