# Harnessing Accelerometer Technology for Inclusive Mobile Learning

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## ABSTRACT

The goal of this research is the establishment of a usable and accessible mobile learning system for the inclusion of both blind and vision-impaired students within mainstream education through independent, collaborative and ubiquitous mobile learning environments. An essential component of this work is the enhancement of the field to enable all students to work successfully together despite vision disabilities for the achievement of a learning outcome.

Given the advancements in mobile technologies, and the personal nature of mobile devices, there is a lot to be gained, especially for the vision-impaired, by harnessing new technologies for education. Some technological advances can increase the divide between such students and their fully sighted peers. However the incorporation of technologies such as the accelerometer, now standard within many modern mobile phones, provides an opportunity to develop new inclusive mobile learning applications.

The accelerometer could enable us to present a vision-impaired student with the capability to successfully play and interact directly with their fully sighted peers within a collaborative game to achieve a single outcome. This could be achieved without the heavy reliance on visual interfaces that were a necessary part of earlier mLearning models. The student would interact with the game through specific movements of their mobile handheld device. The device, for example, would be moved in one direction to give a specific command, while tilting and shaking the device would be used to command separate specific functions of the game. The student's interaction through the accelerometer could be enhanced through the provision of both haptic and audio feedback as they twist and tilt the handheld mobile device to interact with a learning game, removing altogether the need for the incorporation of a visual interface. The incorporation of wireless technologies such as Bluetooth, would allow for the provision of a collaborative environment for mobile learning, allowing all students to communicate via their handheld device, regardless of the disabilities faced by individual learners.

Providing the ability to create an engaging, level playing field for such students could reduce the digital divide currently in existence for the future success of mobile learning environments.

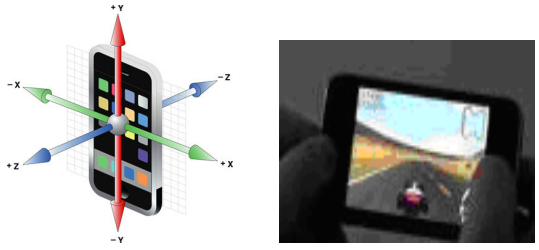


**Figure 1. Mobile Phone Accelerometer**

## Categories and Subject Descriptors

H.5.2 [**Information Interfaces and Presentation**]: User Interfaces– Interaction Styles, K.4.2 [Social Issues]: Handicapped Persons / Special Needs, K.3.1 [Computer Uses in Education] Collaborative Learning, Computer-Assisted Instruction (CAI)

## General Terms

Measurement, Performance, Human Factors,

## Keywords

Mobile Learning, Vision Impaired, Accelerometers, Interaction, Learner Styles.

## 1. BENEFITS

The contribution of this research to the field of Mobile HCI is the exploration of a new and potentially significant means of device interaction for the vision impaired within inclusive collaborative mobile learning. The achievement of such inclusion is based on


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the advent of accelerometer technology, now included as standard within most mobile phone devices. Accessibility and usability within mobile learning have become a major area of contention for the vision-impaired. The development of systems that are exclusive to fully-sighted users has created an isolation factor for the vision-impaired within the field. The emergence of Touch Screen Devices, whilst providing the advantage of larger displays, has eliminated buttons altogether. Buttons provided the user with a tactile marker, the removal of which has made data entry increasingly difficult. This, when combined with the improved display of web pages on mobile devices with the emergence of devices like the iPhone, has further alienated the vision impaired who can experience difficulty with reading such pages through mobile screen readers. There have to date been many efforts in research to overcome the problems faced by the vision impaired user confronted with such technologies. In many cases, however, these efforts can further isolate the vision impaired mobile learner by drawing increased attention to their disability. Therefore the benefits to be gained by harnessing accelerometer technology for mLearning are quite significant. This technology has the potential to overcome reliance both on highly visual interfaces and touch screen / key interaction. The use of an accelerometer, when combined with complementary multimodal feedback, can overcome many of the limitations faced by vision impaired users when confronted by mobile technologies by removing the need for visual interaction altogether. Also, the provision of inclusive rather than exclusive mobile learning systems will significantly reduce the current digital divide that exists between vision impaired students and their able bodied peers, while at the same time will make it possible for all students to work together on a single project for a single outcome. This would establish a collaborative harmony between peers and remove the stigma attached to the vision-impaired that can lead to isolation. This, through the ubiquitous nature of mobile technology can be achieved both in and out of the classroom for successful learning purposes.

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