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# Learning in the Age of Ubiquitous Computing: Exploring the Impact of Mobile Technologies on Individual and Collaborative Learning Practices

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**Key words:** *Calm computing, collaborative-learning, emerging technologies, e-learning, mobility, mobile-technologies, m-learning, pervasive-learning, social-networks, UbiComp, wireless-networks.*

## Abstract:

*This paper explores the emergence of a pervasive learning culture within the context of ubiquitous computing scenarios. Furthermore, this paper examines the impact of mobile technologies on collaborative learning and highlights the key characteristics of these phenomena.*

## 1 Introduction

### 1.1 A new quality of learning

It is 07:00am, and Student X is waking from her slumber and begins to prepare herself for a busy day at her University. While performing her daily morning routine Student X glances at the display of her Internet enabled mobile phone to see if there are any changes to her academic schedule that day and to see whether there are any messages or updates to the courses she is taking. As Student X walks into her kitchen to prepare a cup of tea for breakfast she instantly receives a message from one of her classmates inviting her to meet at a local café so that they could (physically) meet to discuss a seminar paper that is due today. Student X responds verbally to her classmate (through a voice-texting service) that she cannot meet that morning, but offers that she could read the revisions of their paper on her way to campus. Her classmate instantly sends a revised version of their seminar paper to Student X's phone, which is simultaneously printed-out on Student X's networked enabled printer. Student X finishes drinking her tea and grabs the printout of her paper and makes her way the University campus.

On Student X's commute she reads the paper and comes across some concepts she is not completely familiar with and consults some academic resources on the Internet through her phone. Upon arrival to campus she glances at her mobile and informs herself as to whereabouts of her colleague on a map that indicates the presence and global positioning of her friend. She knows that her friend is waiting for her in the Main Library and proceeds there to meet-up and finish their paper.

Student X and her friend are just about finished with their paper, but they both realize that they will be late for their lecture, so they logon to the University media server on their mobiles and begin to listen to a live audio stream of the lecture over their Bluetooth headsets, while making their way to the lecture hall. While in the lecture hall they turn off their headsets in order to listen to the lecture in person. While taking their seats they receive the lecture notes and presentation slides via Bluetooth for their personal reference. Furthermore,

the attendance (physical presence) and apparent lateness of the two students is automatically logged in the Lecturers attendance log-book. Student X and her colleague continue to work on their paper while half-listening to the lecture in order to meet the paper deadline as they know that they will be able to review the lecture again later either on a video or audio podcast. Welcome to one possible scenario of a new quality of learning this paper calls pervasive and ubiquitous learning.

## 1.2 Overview

The adoption and utilization of mobile information and communication technologies within formalized, informal and non-formal learning contexts is fundamentally transforming the ways in which society views and engages in educational practices. It is commonly accepted that mobile information and communication technologies have tremendous potential to make an immense impact on education. This impact can be observed within the context of individual and collaborative learning practices. Students, individually and collectively, are utilizing mobile technologies to augment and enhance existing learning scenarios, but are also creating a “new quality of learning” which is heavily dependent on mobile technologies. This new “quality of learning” can be observed in how students harness mobile technologies and wireless networks to create a culture of ubiquitous and pervasive learning, which can be observed on many university campuses today.

The purpose of this paper is to briefly explore the concepts of *Ubiquitous* and *Pervasive Learning* as demonstrated in the possible learning scenario illustrated above with Student X. The central questions behind this research are the following:

1. What is *Ubiquitous and Pervasive Learning*?
2. Are *Ubiquitous* and *Pervasive Learning* practices feasible and will this bring a positive impact on education?

The research conducted to address these questions above is based mostly on personal observations and practice supplemented with a partial review of existing literature on topics related to the subject discussed in this paper. It is important to stress that this research paper is exploratory in nature, and thus, will not be able to cover in depth many of the concepts and topics surveyed. It is helpful to view this work as a medium to encourage thoughtful discourse and to inspire dialogue regarding how the emergence of ubiquitous computing practices are impacting individual and collaborative learning and education in general.

## 2 Ubiquitous and Pervasive Learning

At present we are beginning to see the first glimpses of ubiquitous computing unfolding within many technologically oriented societies. Although this observation is not universally observed throughout the globe, these first signs show promise of a ubiquitous computing culture manifesting itself.

Mark Weiser’s vision of ubiquitous computing has had an enormous impact on the formation of the field of *Ubiquitous Computing*. Weiser’s central thesis was that while “computers for personal use have focused on the excitement of interaction...the most potentially interesting, challenging and profound change implied by the ubiquitous computing era is a focus on calm computing.”[9] According to Yvonne Rogers one motivation behind much of UbiComp research has been to make our lives convenient, comfortable and informed. Which is following in the footsteps of Weiser’s *calm computing* vision. [7] This paper draws on his vision and attempts to define ubiquitous learning in relation to ubiquitous computing calm computing vision to make the lives of the students’ “convenient,” “comfortable,” and “informed.”

## **2.1 Ubiquitous Learning**

According to Weiser, “ubiquitous computing enhances computer use by making many computers available throughout the physical environment, while making them effectively invisible to the user.”[7] If this scenario could be duplicated and applied to educational institutions a new quality of learning could (and should) emerge. This new quality of ubiquitous learning can help make the lives of students and faculty alike more convenient, comfortable, and informed.

In the possible ubiquitous learning scenario described above with Student X, we observed that ubiquitous learning can enable a more flexible way of learning and has the ability to enhance and potentially bolster individual student’s ability to achieve their own personal learning goals. This can be done essentially by making many computers available throughout a physical environment, while, according to Weiser, “making them effectively invisible.”[10] The invisibility of the technology (computational power) is one of the main characteristics of ubiquitous learning and is an enabler or what is called pervasive learning.

## **2.2 Pervasive Learning**

When speaking about the pervasiveness of learning this refers to the aspects of learning that are more visible and tangible to the learner. That is, that the learner is able to access digitized artefacts (such as: pdfs and audio/video files) to augment and supplement individualized or group learning scenarios under almost any condition. That is that pervasive learning gives students the ability, and more importantly the flexibility to learn “anytime”, “anywhere.” These characteristics can be understood as “the” main enablers of pervasive learning practices.

## **3 Is Ubiquitous and Pervasive Learning Feasible?**

In order to answer the question whether Ubiquitous and Pervasive Learning practices are feasible one must also ponder upon the question of why would anyone want to do this. Rogers asserts that: “humans are very resourceful at exploiting their [own] environment and [are adept at] extending their capabilities using existing strategies and tools.”[8] At present we are beginning to see the first glimpses of ubiquitous learning unfolding because individuals see a value in making the process of learning more “flexible” and learner-centred. According to Glotz,[3] Keene,[6] Rheingold,[7] and Alexander,[1] students are already harnessing the power and potential of mobile information and communications technologies in order to augment their own personal and collaborative learning. But, how will this make an impact on education.

### **3.1 Impact on Education**

As with any learning scenario involving technology there will always be disruptions to the prevailing ways and methods of accomplishing things. Educational systems, regardless of their maturity, are experiencing incredible stresses on their institutions as many societies are being called upon to equip their citizens with new skills for the present and emerging knowledge economies. Many schools are constrained by budgetary limitations while experiencing a surge in student enrolment. Technology is one tool to help find creative solutions to overcome challenges and obstacles for individuals to obtain a quality education.

As to whether ubiquitous and pervasive learning practices will bring about a positive impact on education it is too early to give a definitive answer. Although, upon speculation it can be argued that ubiquitous and pervasive learning practices can theoretically be a catalyst to positive change within educational systems and equipped individuals with capacity to pursue and complete their own personal education goals.

## 4 Conclusion

The purpose of this paper was to briefly explore the concepts of *Ubiquitous* and *Pervasive Learning* and to attempt to answer whether ubiquitous and pervasive learning practices are feasible. As this paper is exploratory in nature it was not able to cover in depth many of the concepts and topics surveyed. It is helpful to view this work as a medium to encourage thoughtful discourse and to inspire dialogue regarding how the emergence of ubiquitous computing practices are impacting individual and collaborative learning and education in general. With regards to the whether ubiquitous and pervasive learning practices are able to make a positive impact on education it has been determined that it is too early to speculate on this, but there are many promising signs that ubiquitous and pervasive learning practices can and will make tremendous contribution to bring about positive change within educational systems and allow individuals and collaborative learning communities to achieve the desired education goals

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