UBIQUITOUS TECHNOLOGIES IN TEACHER EDUCATION: DEALING WITH PARADIGM SHIFT IN PEDAGOGICAL PRACTICES

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ABSTRACT

Ubiquitous learning is more than just the modern educational paradigm or method and delivers a vision of learning which is connected across various stages on what we learn. The interaction of these bodies of knowledge, both theoretically and in practice, produces the types of flexible knowledge needed to successfully integrate technology use into the practice of teaching. This study focused on divergent technologies and tools available to the present teacher educator in higher educational institutions in Ghana and how these technologies have created a paradigm in instructors’ pedagogical practices. The study which was based on the objectivist principles used activity theory as a framework. A blend of quantitative and qualitative tools were used to collect data from participants. The quantitative data were reported in standard deviation, means and frequencies, while the qualitative data were summarised and reported with the theory. The main findings of this study showed that instructors know about the existence of technologies, tools and software applications, and have been using some of these technologies and applications. However, some instructors displayed naivety about the use of some of these technologies and applications. The study is theoretically significant as it seeks to critique how pedagogical practices are dealing with ubiquitous technologies. Consequently, the study aims to provide data and the platform to technology trainers and specialists to help develop appropriate professional training materials and address teachers’ technology needs during teachers’ professional development programmes in ways that connect and reflect pedagogical knowledge and the use of technologies for instruction.

Keywords: Ubiquitous Technologies, Activity Theory, Pedagogical Practices, Teacher Education, Paradigm Shift

Introduction

Technology devices have become mobile, portable and networked in the 21st Century and have become omnipresent in everyday life. The use of mobile devices is now common among a wide range of age groups due to its affordability and availability. These technologies classified as Information and Communication Technologies (ICTs) are used for collecting, creating, preserving information among others.

ICTs have become indispensable in our lives as it permeates all realms of life, from the workplace to the sports field, in schools and on a personal or social level. The existence of a wide variety of ICTs is an indication that ICTs go far beyond computers and the internet (Mathevula & Uwizeyimana, 2014). Wilson, (2014) reports that the advancement of technology initiated by digital revolution through technology innovations has caused a paradigm shift in the education sector and has affected content delivery.

The explosion of ICTs has affected the entire world and has impacted the life of many people and jobs in all fields. However, as education is the main vehicle for human resource and capital
development, there is the need for education to heed and embrace the constant changes in the world of work (Agbo, 2015; Bidarian & Mohammad, 2011).

The integration of ICT in education can take several forms such as information and computer networks, digital content, internet sites, multimedia and others (Alazam, Bakar, Hamzah, & Asmiran, 2012; Wilson, 2014d). A study conducted by Akarawang, Kidrakran and Nuangchalerm (2015) reported that teachers must gain suitable knowledge and abilities to use ICT to effectively teach students. Starčič (n.d.) also shares a similar idea that the teacher has to consider teaching and learning approaches aligned with preferences of students and digital literacy.

This study argues with a focus on the fact that simply putting more computers in schools will not solve the problem, but rather that teaching, learning, and technology integration need to be reconceptualised within a ubiquitous computing framework before the full educational possibilities inherent in digital technologies can be realized.

**Ubiquitous Technologies in Education**

Ubiquitous computing integrates technology into the environment, giving the opportunity to users to utilize it anytime and anywhere. It differs from traditional systems where the user is bonded to a computer in a specific place. Now it is possible for a user to utilize the technology without the restriction of place or time (Kolomvatsos, 2007).

These days the common-sense meaning of ubiquitous computing is being able to access the Internet or computer networks from virtually anywhere at any time, through digital devices such as mobile phones, wireless-ready laptops, tablets among others. According to Bruce (2010) ubiquitous learning has been linked closely to an array of new ICTs. And that these technologies have become portable, wearable, and distributed and no longer confined within large metal boxes or even tied to the wall with wires.

Ubiquitous computing in education can be defined as “teachers and students having access to technologies whenever and wherever they need it.” Ubiquitous computing includes devices (computing devices, the Internet, services) that are usually operated offline, but are occasionally connected to the cloud or network through computers. With ubiquitous computing, the technology is always accessible but it is not the focus of learning. Instead faculty and students are active partners in the learning process. They decide what technology is needed, what to learn and how best to create new knowledge (Baran, 2014; Kolomvatsos, 2007; Mathevula & Uwizeyimana, 2014; Mccarty, 2011; Wilson, 2014; Yahya, Ahmad, 2010).

The past decade has witnessed a dramatic use of technology in the classroom. Hay (2013) concludes that with the prevalence of mobile devices in schools, it’s only a matter of time before ubiquitous computing becomes a reality in education. Bruce (2010) concludes that a kind of ubiquitous learning has arrived without any intention or forethought; the technologies alone have made it happen. Thus there is no doubt that new forms of learning are already trendy through new media, social networking and online videos sites.

van Hover, Berson, Bolick and Swan (2004) discuss the concept of ubiquitous computing and the impact this technology shift may have on social studies curricula, teacher preparation, software development, and research agendas. The major result of the study is that across diverse learning styles, majors, and genders, many of these media are deemed to be useful for all learners.
As Bruce (2010) puts it, technologies alone are far from sufficient. Instead, there is the need to think about how technologies serve in relation to changing learning needs, and how diverse resources can be used in a concerted way. Bruce further states that technologies need to be re-created with a vision of ubiquitous learning if they are to achieve that goal.

**Emerging Paradigms in Education**

Over the past two decades, technology devices have become mobile-portable and networked and have become pervasive in everyday life. Mobile devices have become common among a wide range of age groups due to affordability and availability. There is pervasive unanimity that technology is now an unavoidable and vital part of our daily life, work and home experiences (Baran, 2014; Kolomvatsos, 2007; Wilson, 2014).

Subsequently, the call for schools to move to a more technologically integrated approach to teaching and learning has been echoing among departments of education in various countries (Wilson, 2014). Wilson discovered that regardless of the quantity and quality of technology placed in classrooms, the crucial point to how those tools are used is the teacher. Hence teachers must have the competence and the right attitude towards technology. Guzman and Nussbaum (2009) agree with Wilson that teacher training must be at the heart of any attempt to formally integrate technological tools into classroom activity. This training should form the basis for thoughtful reflection that will support the revolution of instruction and make a major contribution to the adoption of technologies by teachers.

Guzman and Nussbaum (2009) echo that the process of integrating technology into classroom work has emerged as a significant focus of study in educational research. This has become necessary with the growing number of technology projects implemented in schools. Multimedia tools and applications have found their way into the classroom.

The significance of professional development for the fruitful uptake of ICT in the classroom attracts strong endorsement from the research. Mathevula and Uwizeyimana (2014) advocate for instructors to acquire technology competencies. These competencies are organised into five aspects: productivity, communication, research, media and presentation. Those are the skills that just about every teacher needs to master, no matter the subject or grade.

**Technology and Pedagogical Practices**

Teaching with technology is complicated considering the challenges newer technologies present to teachers. Technology applies equally to analogue and digital, as well as new and old technologies. Alternatively, novel computational paradigm, such as pervasive and ubiquitous computing, may create new possibilities for interactivity, enabling designers and technologists to create novel hybrid artefacts and environments, (Hall & Bannon, 2005; Harris & Koehler, 2009).

Most traditional pedagogical technologies are characterized by specificity (a pencil is for writing, while a microscope is for viewing small objects); stability (pencils, pendulums, and chalkboards have not changed a great deal over time); and transparency of function (the inner workings of the pencil or the pendulum are simple and directly related to their function).

Also complicating teaching with technology is an understanding that technologies are neither neutral nor unbiased. Rather, particular technologies have their own propensities, potentials, affordances, and constraints that make them more suitable for certain tasks than others (Harris & Koehler, 2009).
Exhausting instances from ICT lectures, the study debates on how teaching needs to be reconceived more as “guiding” than “drilling”; how learning needs to become more the responsibility of the student, and placed with her in an expanded space and time that extends beyond the classroom, and how technology integration needs to be understood not as an add-on, device-driven initiative, but one motivated by teaching and learning needs and in which multiple technology choices are readily available to teachers and students both within and beyond the classroom.

Some Pedagogical Practices
Though pedagogy is sometimes seen as an unclear concept, it is basically an amalgamation of knowledge and skills necessary for effective teaching. Pedagogy comprises the philosophies and methods used for instruction to be employed by teachers. There is no known fixed practice that suits all learners at the same time. Gill (2013) concluded that no two instructors are alike and teachers with classroom teaching experience will agree that their style of teaching is unique.

Furthermore, some of the pedagogical practices discussed by Gill (2013) lend itself to technology use for instruction. The following methods:
- **Hybrid, or blended style:** This style of teaching has the potential of achieving the inclusive approach of combining teaching style clusters and enables teachers to tailor their styles to student needs and appropriate subject matter it runs the risk of trying to be too many things to all students, prompting teachers to spread themselves too thin and dilute learning.
- **Demonstrator, or coach style:** Though well-suited for teaching mathematics, music, physical education, arts and crafts, provides teachers the opportunities to incorporate a variety of formats such as lectures, multimedia presentations and demonstrations, it is difficult to accommodate students’ individual needs in larger classrooms.
- **Facilitator, or activity style:** This style promote self-learning and help students to develop critical thinking skills and retain knowledge through exploration. It challenge students and guides them toward discovery rather than lecturing facts and testing knowledge through memorization.

Research Problem
The emergence of technologies in our daily lives has created a paradigm shift in the medium of knowledge creation and delivery. It is common knowledge that many teachers in Ghana earned degrees at a time when educational technology was at a very different stage of development than today. The curriculum that introduced teachers to technology actually focused on the basic knowledge about the advantages and uses of the computer. Attention was not given to the use of technology as a tool to support lesson delivery. It is, therefore, not surprising that even though teachers of today have studied ICT as a course during their formative years as a teacher educator, they still refuse to use terminologies associated with technologies.

It is, thus, not surprising that teachers do not consider themselves competent or adequately prepared to use technology in lesson delivery and often do not appreciate its value or relevance to teaching and learning. Furthermore, teachers have often been provided with inadequate training for this task. Ubiquitous access to digital technologies is becoming an integral part of our daily lives, yet, despite over a quarter of a century of educational technology initiatives, ubiquitous computing in pedagogical practices remains conspicuously absent from our schools.
Teaching professionals need to recognize that the heart of good technology integration lie with the recognition of the relationship between technology and pedagogy. Students of today are interacting with technology more than their instructors when they were their age. Abundance of technologies have disrupted the medium through which information is created and disseminated. Acquiring knowledge in the classroom is simply not enough these days. Ubiquitous computing is exactly as you would imagine; it is the idea of technology being accessible anywhere and at any time (Hay, 2013). By entrance of ICT into teaching/learning process, it is necessary to focus on modern pedagogy paradigm in which the learner is the centre of learning with a practical learning chance for the learner.

However, the fact that this research was conducted in a developing country, namely Ghana, where some schools are still struggling with basic infrastructure, the types of equipment that are the focus of this research are computers (desktops, laptops), data projectors, software applications, Word Processing, Internet, digital cameras, television (TVs), mobile phones and tablets.

Kwame, Kwarteng, and Kyere-djan (2013) attest to the fact that Ghana is both technologically and economically less developed and this has led to the slow adoption of ICTs in education. They also agree that ICT have wide reaching implications on pedagogical practices. Ghana is among the countries that are currently attempting to promote IT in schools to turn the country into an information society.

According to Gill (2013) despite a plethora of government initiatives and academic researches worldwide, effective use of ICTs in teaching and learning remains an elusive act with the tool potential underutilized by educationalists and inconsistently practiced in schools. This study focused on the abundance of technologies with a potential to impact on the pedagogical practices of instructors in teacher educational institutions.

**Teacher Education Framework in Ghana**

The framework of education has relied on a relatively static structure (e.g., the case method for law and business). However, pedagogical practices have not been stagnant. Some pedagogical strategies are associated strongly with one discipline or another but most disciplines utilize diverse set of strategies that best fit the learning goals. Teacher education framework in Ghana involves two levels, the colleges of education and the two teacher education universities.
Theoretical Framework

The theoretical framework has been informed mainly by the concept of viewing implementation dynamics as the interplay between organisational issues and personal concerns (Wong & Li, 2011). The mainstream framework of computer-interaction research has come under increasing criticism lately because of the gap between research results and practical design. According to Uden, Willis and Uk (2001) the main criticism is that traditional cognitive of design is not able to penetrate the human side of the interface.

Uden, Willis and Uk (2001) justify the use of activity theory by saying that it is a philosophical and cross-disciplinary framework that provides different forms of human practices. In reality, AT (Murphy & Rodriguez-manzanares, 2008) investigates human activity, understood as activity in a specific social setting such as work or learning.
**Fig 2: ICT implementation in schools** (Adapted from Wong & Li, 2011).

Figure 2 as adapted from Wong and Li (2011), showcase the interplay of activities, policies and people in the education sector.

**Methodology**
This study which used a blend of reports on the qualitative aspect of the study adopted a Likert scale self-reporting questionnaire to collect empirical evidence.

**Research Questions**
To find answers to the study, the following research questions were used:

1. What technologies are available in educational institutions?
2. To what extent are technologies used in lesson delivery?

**Hypothesis**

1. \( H_0 \). There is no significant relationship between the use of social media and technology in teaching

2. \( H_1 \). There is significant relationship between the use of social media and technology in teaching

**Discussion of Findings**
The results of the study revealed that many of the faculty members who took part in this study believed in using learning theories as a foundation for selecting technology for instruction. However, a great number of teachers felt they did not sufficiently match learning theories with their selection of instructional technology.

**Research Question 1: What technologies are available in educational institutions?**
Studies have shown that educational institutions have invested heavily in the provision of ICT infrastructure to support the study of ICT (Guzman & Nussbaum, 2009; Wilson, 2014). Table 1 presents data of facilities and tools commonly provided by institutions for academic use.
Table 1: Technology Availability in Educational Institutions

<table>
<thead>
<tr>
<th>Technology Availability</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer labs</td>
<td>220</td>
<td>100</td>
</tr>
<tr>
<td>Internet</td>
<td>187</td>
<td>85</td>
</tr>
<tr>
<td>Digital camera</td>
<td>50</td>
<td>23</td>
</tr>
<tr>
<td>Projector</td>
<td>220</td>
<td>100</td>
</tr>
<tr>
<td>Photocopier</td>
<td>140</td>
<td>64</td>
</tr>
<tr>
<td>Software applications (word processor, etc.)</td>
<td>220</td>
<td>100</td>
</tr>
<tr>
<td>Learning Management Systems/Course Management System</td>
<td>50</td>
<td>23</td>
</tr>
</tbody>
</table>

Research Question 2: *To what extent are technologies used in lesson delivery?*

Traditional classrooms, and for that matter pedagogy, have suffered the brunt of technology influx. Lesson delivery and content creation have been affected by technology. Technology has made learning everywhere and anywhere possible. A learner is no longer required to be in a formal classroom only to study. New technologies have brought many changes in teaching, and of course in learning.

Table 2 presents data on self-reporting feedback from instructors. The data showed that some of the instructors used technology to support their pedagogical practices. However, the means of means value of 3.63 provides an insignificant use of technology in teaching. Technology use for instruction is not extensive.

Table 2: Pedagogical use of ICTs

<table>
<thead>
<tr>
<th>Pedagogical use of technology</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>I prepare class activities that integrate instructional technology</td>
<td>75</td>
<td>3.3600</td>
<td>1.42032</td>
</tr>
<tr>
<td>I task my students to develop instructional materials using technology</td>
<td>75</td>
<td>3.6400</td>
<td>1.24813</td>
</tr>
<tr>
<td>I allow learners to explore technology in learning</td>
<td>75</td>
<td>3.3867</td>
<td>1.33450</td>
</tr>
<tr>
<td>I use PowerPoint to deliver lessons</td>
<td>75</td>
<td>3.2400</td>
<td>1.64267</td>
</tr>
<tr>
<td>I direct students to seek information from the Internet</td>
<td>75</td>
<td>2.7067</td>
<td>1.46834</td>
</tr>
<tr>
<td>I incorporate technology tools such as social media (e.g. WhatsApp, wiki, etc.) to support my teaching</td>
<td>75</td>
<td>3.8267</td>
<td>1.20105</td>
</tr>
<tr>
<td>I use chat to support class discussions in class</td>
<td>75</td>
<td>4.1200</td>
<td>1.20763</td>
</tr>
<tr>
<td>I use Skype to communicate with my learners</td>
<td>75</td>
<td>4.4400</td>
<td>1.09347</td>
</tr>
<tr>
<td>I use twitter to generate interest in class discussions</td>
<td>75</td>
<td>4.5467</td>
<td>1.17742</td>
</tr>
<tr>
<td>I encourage my students to use technology to interact with content</td>
<td>75</td>
<td>3.0667</td>
<td>1.43634</td>
</tr>
<tr>
<td>I encourage my students to use technology to interact with students</td>
<td>75</td>
<td>3.4267</td>
<td>1.51723</td>
</tr>
<tr>
<td>I use learning management system to supplement teaching activities</td>
<td>75</td>
<td>3.8267</td>
<td>1.32923</td>
</tr>
</tbody>
</table>

Mean of means 3.63  
Mean of standard deviation 0.84

The means of means of the participants’ responses indicate that most of the participants sometimes use technology in their pedagogical practices given that the means recorded a value of 3.63.
Research Hypothesis: $H_0$. There is no significant relationship between the use of social media and technology in teaching

The data reports that participants have accounts with social media and that they use social media for various activities. To further find out the level to which they use social media tools to support pedagogical practices a correlation test was conducted.

Table 3: Instructors Use of Collaborative and Social Media Tools

<table>
<thead>
<tr>
<th>Item</th>
<th>E-mail</th>
<th>Skype</th>
<th>Facebook</th>
<th>WhatsApp</th>
<th>Others</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interacting with my students</td>
<td>9</td>
<td>8.0</td>
<td>5</td>
<td>26.0</td>
<td>12</td>
<td>9.0</td>
</tr>
<tr>
<td>Group work</td>
<td>10</td>
<td>9.0</td>
<td>1</td>
<td>5.0</td>
<td>4</td>
<td>1.0</td>
</tr>
<tr>
<td>Research</td>
<td>25</td>
<td>22.0</td>
<td>1</td>
<td>5.0</td>
<td>4</td>
<td>8.0</td>
</tr>
<tr>
<td>Posting activities &amp; assignments to students</td>
<td>12</td>
<td>10.0</td>
<td>4</td>
<td>21.0</td>
<td>5</td>
<td>10.0</td>
</tr>
<tr>
<td>Personal studies</td>
<td>21</td>
<td>18.0</td>
<td>2</td>
<td>11.0</td>
<td>4</td>
<td>8.0</td>
</tr>
<tr>
<td>Exchange mails</td>
<td>21</td>
<td>18.0</td>
<td>2</td>
<td>11.0</td>
<td>6</td>
<td>12.0</td>
</tr>
<tr>
<td>Text messaging</td>
<td>7</td>
<td>6.0</td>
<td>2</td>
<td>11.0</td>
<td>11</td>
<td>22.0</td>
</tr>
<tr>
<td>Support teaching</td>
<td>10</td>
<td>9.0</td>
<td>2</td>
<td>11.0</td>
<td>4</td>
<td>8.0</td>
</tr>
</tbody>
</table>

To further find out the level to which instructors use technology in their pedagogical practices, Pearson’s correlations test was computed. The result showed that there is no significant correlation between the two variables, $r = -.117$, $n = 75$, $p = .319$. Overall, there is no significant correlation between instructors’ knowledge in technology and its use in their pedagogical practices.

Table 4: Correlations between the use of social media and technology usage in teaching

<table>
<thead>
<tr>
<th>Technology</th>
<th>Pedagogical Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>-.117</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.319</td>
</tr>
<tr>
<td>N</td>
<td>75</td>
</tr>
</tbody>
</table>

Research Hypothesis: $H_1$. There is significant relationship between the use of social media and technology in teaching

The analysis from the data shows that there is no statistical significant relationship between teachers’ knowledge of social media and its usage to support pedagogical practices. The instructors who use social media to support their pedagogical practices do so either by chance
Conclusions
The entrance of ICT into the field of education is a valuable chance for performing some alterations and innovations that have the potential for increased productivity in pedagogical practices and also enrich learning. The data from the study showed clearly that, though there is abundance of technology which readily available to both instructors and students, its use for instruction is not widespread. Though institutions have invested in infrastructure, not much has been used to transform pedagogical practices. Instructors continue to teach using the old Victorian way of teaching.

Recommendations
Findings from the study recommends that curriculum planners should infuse technology into various curriculum. Teacher education institutions need to embrace technology for instruction and institute a policy that will require students to use technology in all courses.

References


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