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## Introducing a Sociomaterial Perspective to Investigate E-learning for Higher Educational Institutions in Developing Countries

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### Abstract

*E-learning projects in developing countries suffer enormous challenges because of various factors. Particularly, technologies that are designed and developed outside of a developing country context are causing significant problems when implemented in developing countries. So far e-learning studies in developing countries have examined utilization, acceptance, adoption, success and failure using the following factors: culture, human behaviour towards technology, and organizational influences. This paper reviews different theoretical perspectives used so far and determines that they are not capturing the complexity of the environment of e-learning implementations in developing countries. In particular, the inextricable entanglement of people, technology and the environment is under-appreciated. Furthermore, the complex design implications of that entanglement are not well managed. This paper explores the potentiality of 'sociomateriality' as a new lens to examine the uptake and design of the virtual learning environment in a developing country context. The framework proposed uses the concept of entanglement for examining technology uptake and the concept of sociomaterial imbrication to investigate the design considerations of the virtual learning environment. The proposed framework will be trialled in a forthcoming research project investigating virtual learning environment implementations in state-owned higher education institutions in a developing country.*

### Keywords

e-learning, virtual learning environment, educational technology, sociomateriality, developing countries

### INTRODUCTION

In today's modern world, e-learning is considered to be an accepted standard form of education, particularly in developed countries (Koponen et al. 2011). E-learning has become a mainstream alternative means of delivering instruction and sharing educational resources. According to Bowles (2004), e-learning includes any form of teaching and learning using digital technologies. E-learning is important because it can help improve student skills and the quality of learning (Escobar-Rodriguez and Monge-Lozano 2012; Georgouli et al. 2008). The proliferation of e-learning seems inexorable and educational institutions have been investing in information technology to improve education and training (Torres Maldonado et al. 2011). These technologies are systems that facilitate teaching and learning outside of the physical classroom and also allow the user to create and administer courses in a more organized way. Such technologies are commonly known as a learning management system (LMS), course management system (CMS), or virtual learning environment (VLE). Recently, many educational institutions in developed countries have moved from institutional technology implementation of e-learning (i.e. VLE) to massive open online course (MOOC) delivery.

Following the trend, but not with equal pace, educational institutions in developing countries are also tapping into the new gateway provided by these educational technologies. Adopting online delivery could significantly expand education opportunities to a vast number of people in developing countries who are currently deprived of education because of a shortage of teachers, classrooms and other educational resources (UNESCO 2006). The use of new technologies is advocated by governments in developing countries to reduce the cost of education (Gulati 2008) through the reduction of class sizes, time and cost savings, reduction of printed materials, and the possibility of continuing education (Koponen et al. 2011).

Despite the considerable attention it has gained, e-learning continues to need new or improved approaches (Kahiigi et al. 2011), especially for developing countries where research has not flourished and literature is limited. Moreover, despite the pervasive acceptance of the transformative effects of e-learning, less seems to be understood in a consistent way regarding how they are taken up and how they are integrated in institutions (Hannon 2012). Our research attempts to fill this gap by focusing on why uptake is still low, how the educational technology influences teaching practices, and how teaching practices emerge with the technology in a developing country context. Specifically, we will examine how learning technologies, particularly an open source VLE, is taken up by teachers in a regional state university in the Philippines and how it is integrated into their teaching practices.

One of the authors was involved in an e-learning implementation in a regional state university in the Philippines as a component of an AusAID funded project. This project, called the Basic Education Assistance for Mindanao (BEAM), was instrumental in instituting reforms in the education sector in that part of the world. Because of its success, the partner university continued the e-learning initiative and was able to integrate the developed e-learning packages and educational technology into the university curriculum. However, it is observed that many of the university's teaching staff members were reluctant to use the educational technology in their usual teaching practice. This has aroused the curiosity of the author to investigate further, since it could greatly affect the success and sustainability of the e-learning initiative. Simultaneously, Buche et al. (2012) noted that the underutilization of educational technology by instructors in university settings provides an important complementary area of investigation. Furthermore, we expect to contribute to knowledge and practice, particularly in the context of developing countries where explication of this kind of phenomenon is needed.

This paper presents a novel research framework based on sociomateriality to address the identified gap of an effective means to design e-learning implementations for developing countries. The paper starts with a brief introduction including the motivation of the authors. This is followed by a brief discussion of e-learning in developing countries, which presents the background and context. Next, a review on various relevant studies with different perspectives is presented followed by a discussion on contemporary approaches using the sociomaterial perspective. In addition, the sociomateriality theory and the reasons why it is considered leading to the presentation of the proposed framework for investigating design considerations of virtual learning environments using the sociomaterial perspective. Finally, this paper concludes with a recap and discussion of future research directions utilizing the proposed framework.

## **E-learning in Developing Countries**

While e-learning may be a promising phenomenon, there is a myriad of challenges that confront its implementation and adoption. This is particularly felt in developing countries where a scarcity of resources is experienced (Depover and Orivel 2013). Given this circumstance, however, it is important to note that sufficiency of ICT resources is not a panacea for all e-learning problems in developing countries. In fact, even within a single developed country, technological disparity because of inequitable distribution of resources is also evident (Fong 2009). Nevertheless, such an issue is often highlighted as developing countries continue to catch up in terms of infrastructure. Another equally important challenge of e-learning in developing countries is design mismatch. Often, learning technologies adopted in institutions in developing countries are designed and developed in a different context (mostly from developed countries). This issue of design and local actuality mismatch is often seen as an impeding factor for the uptake of learning technologies in developing countries (Heeks 2002).

Our initial investigation of e-learning in developing countries focuses on a few key elements. Firstly, perhaps the most challenging factor affecting the uptake of e-learning in most developing countries is sufficient and suitable infrastructure. Developing countries still suffer from a lack of infrastructure for enabling the use of ICT in education (Khan et al. 2012; Rajesh 2003; Shaikh and Shamim 2012). However, recent developments have introduced significant improvements in infrastructure, especially mobile communications that now cover a majority of the areas (Evans 2012; Rao 2012). The improvement in infrastructure and delivery of broadband services indicates that e-related services will likely continue to flourish in developing countries. As such, it is important to examine how e-learning can be improved or properly implemented by comprehensively understanding the change processes that emerge.

Secondly, because of the design-actuality mismatch, educators in developing countries often question the cultural and pedagogical appropriateness of e-learning (Pagram and Pagram 2006). This questioning arises because e-learning implementations in developing countries seem to just replicate technologies designed in other contexts (Ssekakubo et al. 2011). E-learning models and technologies developed and used in one culture often reflect a fundamental shift in educational paradigm in that culture (McLoughlin and Oliver 2000; Olaniran 2009). However, adopting these technologies should not represent a call for the unification of the educational values of developing countries and developed countries. Instead, it requires the developing countries to make a gradual change of educational practices of their own (Masoumi and Lindstrom 2009). Similarly, a change of mindset, which includes system wide redesign and rethinking, is required if e-learning is to be pursued (Dela Pena-Bandalaria, Melinda M. 2009; Librero 2004). Hence, cultural and pedagogical appropriateness may not be the real issue requiring investigation or resolution. Instead, the processes involved in the paradigm shift require research attention; the practices of people (administrators, teachers and students) with technology and the institution need to be understood.

## LITERATURE REVIEW

A number of essential factors have been used so far to examine e-learning in developing countries using different perspectives which are described below. These perspectives were used to explore the possibility of using sociomateriality as a lens in investigating design considerations of virtual learning environments in a developing country context.

### Culture

The issue of “cultural fit” plagues most e-learning implementations in developing countries as they struggle to adopt technologies designed and developed in different cultural settings. According to Ssekakubo et al. (2011), e-learning implementations in developing countries are just mimicking what developed countries are doing with the expectation that the same benefits will be achieved. However, many such implementations fail because the teaching and learning process is often not contextualized to the needs of the users (teachers and learners) in the environment. Although e-learning, particularly the use of VLEs, is believed to be pedagogically and culturally neutral, it is important to investigate cultural appropriateness because learning is a cultural activity (McLoughlin and Oliver 2000).

Culture encompasses multiple aspects of human behaviour, including shared beliefs and values of people belonging to a group or society. The social environment is central to this notion of culture since it is where people interact and make meaning of their life experiences. Bodley (2011) viewed culture in three different aspects, namely, mental, behavioral and material. This categorization helps investigators to consider specific aspects of culture such as (1) the mental rules that people follow, (2) understanding daily life behaviors in a society and (3) understanding how people produce products (Wang and Reeves 2007). Our interest is on the third dimension, which has often been ignored even in some cultural perspectives.

A number of studies underscored the importance of culture in e-learning. Chen et al. (1998; 1999), argued that the pervasive influence of culture is one of the essential foundations in designing technology-based learning systems. Likewise, Uzuner (2009) expressed that cultural sensitivity must be highly regarded in VLEs to avoid a “one size fits all” approach in the learning process. Similarly, e-learning studies in developing countries recognize culture as essential element when implementing educational innovations. For instance, Masoumi and Lindstrom (2009) argued that cultural diversity is a critical factor in the design and use of e-learning specially when development and globalisation is considered. Barton et al. (2008) emphasized a distinct culture of pioneers that champions e-learning through the creation of mentor-peer-network that provides support and collaboration to increase uptake and continuance of e-learning in a Malaysian university. Lastly, Palis (2006) showed how culture is challenged and used to facilitate cooperative behavior that contributes to the success of technology intervention.

Viewing culture as the embodiment of ideals into the social environment and considering artefacts as products that also influence humans as agents of the society carries an entanglement perspective which is posited by the sociomateriality of everyday life. This view relates to the design and development of IT artefacts and local user actualities which must be taken into account to avoid design actuality gap (Avram and Wulf 2011; Heeks 2002).

### Human Behaviour towards Technology

At an individual level, the technology acceptance model (TAM) of Davis (1989) is widely used in IS research to investigate user acceptance and adoption. TAM has four constructs, namely, perceived usefulness, perceived ease of use, behavioral intention to use and actual system use. Accordingly, it has been modified and extended a number of times (e.g. TAM2 (Venkatesh and Davis 2000), TAM3 (Venkatesh and Bala 2008), UTAUT

(Venkatesh et al. 2003)). Similarly, a number of studies revealed that TAM is the most widely used acceptance and adoption model in e-learning research (Duan et al. 2010; Šumak et al. 2011). For example, TAM or its derivatives (extended TAM) has been used to investigate employees use of e-learning systems (Lee et al. 2013), acceptance of Google Application for collaborative learning (Cheung and Vogel 2013), teacher acceptance of educational technology (Yuen and Ma 2008),

Although these models have contributed partially to the understanding of e-learning success “these models tended to focus on technology” (Sun et al. 2008 p. 1184). For instance, Sun et al. (2008) argued that technological design is significant in the student’s perception of usefulness, ease of use and satisfaction to which e-learning success can be attributed. Drawing on the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003), Torres Maldonado et al. (2009; 2011) posited that “e-learning motivation” and “social influence” positively affects behavioral intentions while use behavior has a positive influence on e-learning motivation, hence, affecting technology adoption.

On the other hand, other e-learning studies utilized the IS Success Model (ISSM) which advocated for system and information quality as variables that influence the use of technology and user satisfaction leading towards individual and organizational outcomes (DeLone and McLean 1992). For example, Wang et al. (2007) made use of the ISSM conceptual model to develop an instrument that empirically measure e-learning systems success (ELSS). The study of Bhuasiri et al. (2012), drawing on social cognitive theory, IS success model, and motivation theory, found out that curriculum design is important for learning performance while technology awareness, motivation, and changing learners’ behaviour are prerequisites for successful e-learning implementations. Further, they revealed the six most important factors influencing e-learning success in developing countries, that is, (1) increasing technology awareness and an attitude toward e-learning, (2) enhancing basic technology knowledge and skills, (3) improving learning content, (4) requiring computer training, (5) motivating users to utilize e-learning systems, and (6) requiring a high level of support from the university (Bhuasiri et al. 2012). It can be observed that this recent study on e-learning in a developing country setting focused on the individual’s characteristics, which is congruent to the suggestion of Andersson and Gronlund (2009) who expressed that studies in developing countries should shift from contextual to individual focus.

The seemingly technological stance of e-learning studies presented in this section highlighted human behaviour towards technology. In most cases, success of technological implementations, such as e-learning, was attributed to usage behaviour and satisfaction towards the use of technology. Although this approach analytically describes the relationship between technology and its users, it fails to present how such technology emerges and how users are influenced by technology. Looking at this perspective, there seems to be a lack of understanding of how the technology emerges as part of the process where it is intricately entangled with the circumstances within which it is created (Shotter 2011). As such, considering a sociomaterial approach will shed light on the missing link evident in such a dualistic view of technology.

## **Organizational Influences**

As e-learning pushes for a shift in educational practices it requires adequate preparation and a change management strategy. This is where institutional/organizational factors play an important role when instituting reforms to education. Such factors are believed to be important in the success and failure of any information systems implementation and adoption. McPherson and Nunes (2006) stressed that for e-learning to be successful, managing the change process effectively is the way forward. The change process includes consensual debate, agreement and proper alignment of goals and strategies and providing adequate support.

Several studies have explored the organizational culture and its relationship to institutional policy and e-learning use. In developing countries, for instance, Librero (2004) emphasized that a change of mindset in the organizational context is essential when pursuing e-learning. Likewise, Masoumi and Lindstrom (2012), as part of their e-quality framework, stressed that successful e-learning implementation depends on how well organizational factors are explicitly considered and how the institution will pursue change. Similarly, Czerniewicz and Brown (2009) maintain that there is a clear relationship between institutional policy and ICT use but emphasize the importance of organizational culture on policy mediation and the manner in which e-learning is embedded in the institution. On the other hand, Stoltenkamp and Kasuto (2011) utilized a non-coercive implementation approach that highlighted various communication and change management strategies aiming at improving user buy-in towards e-learning in a resistant environment. Results indicate that this non-coercive organizational approach developed voluntary buy-in and championing of e-learning by academics.

As presented above, it is clear that organizational issues are essential environmental factors affecting e-learning. A shift in educational practices brought about by educational innovations requires careful understanding of the people and its environment. But, doing this without also considering the materiality of technological artefacts

will potentially disregard one factor over the other. As such, viewing the entanglement of technology and the practices and processes in the organization using a sociomaterial lens will probably enhance change management strategies required in instituting reforms. Orlikowski and Scott (2008a) strongly pointed out that technology, work and organization are inextricably inseparable.

Table 1 shows a summary (non exhaustive) of different perspectives and theoretical foundations used in various e-learning and related studies in developing countries that help inform the current and emerging trend.

Table 1: Relevant IS studies to address e-learning in developing countries

Perspective	Studies	Theoretical Foundations	Focus	Country
Culture	Rao (2011)	GLOBE Cultural Dimensions	Role of national culture to e-learning	India
	Palis (2006)	Social Theory and Experiential Learning	Culture challenges and use towards cooperative behavior on technology interventions	Philippines
	Raza et al. (2007)	Social democratization of knowledge	Sociocultural transformations created by e-learning across the boundaries of different cultures	Asia, Africa, Latin America
	Masoumi and Lindstrom (2009)	Hofstede's Cultural Dimensions	Cultural foundations of e-learning design	Iran
	Pagram and Pagram (2006)	Hofstede's Cultural Dimensions	Significance of religious and cultural beliefs	Thailand
	Barton et al. (2008)	Hofstede's Cultural Dimensions; Cultural understanding of Individuals	Focus on understanding cultural factors affecting online education from the perspective and experiences of teachers	Malaysia
Human Behaviour Towards Technology	Ahmed (2013)	TAM	Predicting and enhancing higher education instructors' participation	Egypt
	Kituyi and Tusubira (2013)	Design Theory on Blended Learning; TAM	Integration of e-learning in higher education institutions	Uganda
	Bhuasiri et al. (2012)	ISSM, Social Cognitive Theory, Motivation Theory	Personal, environmental and system dimensions as critical factors of e-learning	Asia, Middle East, South America, Africa, and Europe
	Torres Maldonado et al. (2011)	UTAUT	E-learning motivation	Peru
	Ssekakubo et al. (2011)	Khan's E-learning Framework	Probable causes of failure	Africa
	Duan et al. (2010)	Diffusion of Innovation	Examined Chinese student's intention of taking up e-learning degrees	China

Organizational Influences	Dela Pena-Bandalaria (2009)	Change Management and Organizational Theories	System wide reform of educational practices	Philippines
	Nawaz and Khan (2012)	Objectivism, Constructivism	Multiplicity of paradigm shifts	Pakistan
	Masoumi and Lindstrom (2012)	E-learning Quality Framework	Significance of organizational factors in instituting educational reforms	Iran
	Khan et al. (2012)	Institutional, Change Management	Barriers that affect the adoption of e-learning in Bangladesh	Bangladesh
	Stoltenkamp and Kasuto (2011)	Institutional, Change Management	Non-coercive change management strategy to improve e-learning adoption in a resistant environment	South Africa
	Stodberg and Orre (2010)	Socio-cultural study of learning	Issues of e-learning development in a public university	Bolivia

## Emerging Perspectives

Contemporary perspectives have emerged that look into the entanglement of both the social and material. Some of these perspectives have different terms but represent the same concepts drawn from sociomateriality. For example, Hovorka and Germonprez (2011) made use of the sociomateriality perspective to extend design research by looking into the phenomenon instead of the products produced through the process called ‘informativity’. This contemporary perspective extends the Cartesian concept of design research which naturally emphasizes the design of the artefact independent of people or the social context in which it is used (Hevner et al. 2004). Informativity broadens design research by looking into the creation and emergence of the phenomenon through enactments in relation to the entanglement and mangling of action, reflection, practice, technology and information (Hovorka and Germonprez 2011).

Consistent with this concept, Boell and Cecez-Kecmanovic (2012) put forward a performative view of information systems conceptualization drawing on the agential realism perspective (Barad 2007). The performative view articulates a contemporary concept drawn from sociomateriality focusing on the entanglement of IT artefacts, work practices, users and developers. It views information systems as integrative phenomena that both represent and enact reality. Similar to the ‘informativity’ perspective this approach looks into the process of entanglement of the material and social.

These recent perspectives are helpful in understanding the complex nature of e-learning that previous studies have failed to consider. Drawing on the concept of sociomateriality, these perspectives equally consider the social and material components that encounter, interpret and constitute each other within a situated context (Introna and Hayes 2011). This entanglement perspective influenced the framing of the proposed framework that will be described below.

## THE SOCIOMATERIALITY THEORY

While many approaches to research in technology tackle the social and material differently, sociomateriality advocates for its constitutive entanglement. Sociomateriality refers to a perspective that recognizes that the material and the social mutually and emergently produce one another, as people, entangled or imbricated with a variety of technologies, carry out their daily practices, material objects are interwoven with, and inseparable from, social activity (Orlikowski 2007). In addition, sociomateriality advocates a non-privileged view of either of the two equally important elements. As such, a technological innovation, such as the VLE, is a sociomaterial assemblage that enables and constrains what can be practically accomplished within an educational institution.

Central to the notion of sociomaterial assemblages is the idea of how artefacts, work practices, and organizations are made up. Assemblages as viewed by Fenwick and Landri (2012) are the active constitution and reconstitution of human and non-human materialities. The analytical gaze is shifted away from discrete entities of people and technology, or ensembles “of equipment, techniques, applications, and people” (Orlikowski and Iacono 2001). From this perspective, artefacts have no meaningful existence aside from their entanglement in a

particular social context, so that the goal is to describe this entanglement within and across organizations over time. This perspective assumes that social and material world is intertwined and emergent over time. We can then reflect on issues and themes that may exist within and across the narratives and focus on the relationship between the entities as they express their interest and how they may influence each other with time (Orlikowski and Scott 2008a).

### **Why Sociomateriality?**

According to Andersson and Gronlund (2009), the majority of the studies related to e-learning challenges in developing countries are focused on technological and contextual factors, while studies in developed countries mostly deal with individuals. Investigations of e-learning in developing countries tend to adopt a dualistic view of educational technology. Such an approach often blurs the material over which educational practices take place and treats material artefacts simply as tools that humans use (Fenwick and Landri 2012). This perspective is problematic because it downplays the material artefacts over human subjects which is not the way we see organizations realistically in everyday life. Orlikowski (2007 p. 1437) stated that “the social and the material are considered to be inextricably related — there is no social that is not also material, and no material that is not also social.” Little has been explored in the design of virtual learning environments (VLEs) and their uptake using the sociomateriality lens accounting for both the “entanglement” (Orlikowski 2007) and “imbrications” (Leonardi 2011) of both social and material factors.

Surprisingly, Orlikowski and Scott (2008a) revealed that only a few (about 4.9%) management studies directly tackle the role and influence of technology in organization. Apparently, technological artefacts, though often and largely utilized in organizations, appear to be less attractive as specimens for scrutiny in organizations, which somehow discounts materiality and its relationship towards organizing. It is believed that this view is due to the increasing complexities of organizations that require detailed specialization and focus on multiple issues, mostly human, cultural and economic factors but not technology. This human-centric approach tends to blur the technical by focusing on the social (Orlikowski 2007). On the other hand, the “utilities” view of technology, just like electricity and water, often blurs and sidelines materiality as it is subsumed by institutional infrastructure. Similarly, the notion of ephemerality of technology makes it hard to track and analyse in detail (Orlikowski and Scott 2008a) which causes it to be overlooked more often.

Finally, in the context of e-learning, sociomateriality helps “balance the disproportionate attention given to either the social implications of technology use or the material aspects of technology design” (Johri 2011 p. 207). Profoundly, sociomateriality can help us to interpretively explain learning practices that emerge with technology.

### **PROPOSED FRAMEWORK**

It is apparent that technology, people and its environment are constitutively entangled. We are moving fast in a digital world and the growing complexity of the connections and relations between humans, technological artefacts and the environment requires consistent explanation. From the different perspectives discussed above, this paper argues that it is necessary to use a sociomaterial perspective to equally and mutually understand the social and material factors influencing the design of a VLE and how it affects uptake of e-learning. Failure to do so may bring us to the same problem that plagues many e-learning implementations: the isolation of very important factors that in reality are actually intertwined.

Educational technology research should consider extending beyond the technology focus and include a broader range of social factors and view technology as socially constructed and negotiated but not with a pre-determined characteristic (Selwyn 2007, 2010). As such, the sociomaterial perspective seems appropriate to counter the pervasive shift towards technology, “the material world is treated as continuous with and in fact embedded in the immaterial and the human” (Fenwick, 2010, p. 105). We will examine how practices are affected by the VLE and how such technology is utilized through heterogeneous sociomaterial relations. Sociomateriality in this context helps trace the process of negotiations and accommodations which constitute the ‘things’ in education (Fenwick et al. 2011). However, while it is true that there are multiple factors that should be considered in e-learning implementations, for the purpose of our research and due to time constraints we will only consider factors identified in our framework.

Consequently, the conceptual framework presented in Figure 1 focuses on two major concepts of sociomateriality – entanglement and imbrication. First, the constitutive entanglement of how technological artefacts and the social environment interplay and emerge is considered. This concept examines how the users, practices, technological artefacts and other factors influence the uptake of the VLE. All of these components, human and non-human, are assumed to be entangled. The objects that will be produced are products of enactment, while enactments emerge through objects. Second, in relation to design considerations, imbrication is introduced to fit to the design orientation of the sociomaterial lens. This concept of imbrications, advocated by



Leonardi (2011), is appropriate because entanglement alone may not be able to explain the negotiation, accommodation and reconfiguration embedded in the sociomaterial relations; entanglement deals only with the inseparability of the material and the social. “If you see a problem as an entanglement, your only options are to accept or not accept: There is no space in between for negotiation and improvement” (Bratteteig and Verne 2012 as cited in Leonardi and Rodriguez-Lluesma 2012). Hence, imbrication is introduced in this framework to handle the design orientation that helps understand the sociomaterial processes and generate insights into how to improve them. Such an approach will help to ascertain appropriate design considerations for a technologically feasible and socio-culturally sensitive VLE that will be acceptable to the people in the environment.

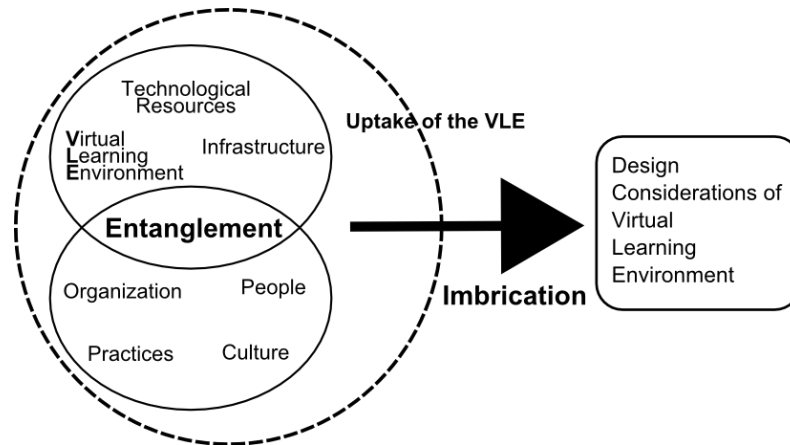


Figure 1. Conceptual Framework [Adapted from (Boell and Cecez-Kecmanov, 2012)]

### Entanglement View of the Uptake of VLE

The concept of sociomaterial entanglement draws on agential realism (Barad 2003), which disproves any distinction between the social and the material. Furthermore, Orlikowski and Scott (2008b) believe that the constitutive entanglement precludes the possibility of viewing the social and material worlds distinctly. The usual individual account of the mutual entanglement of materiality and people’s work practices encouraged this research using the sociomaterial entanglement concept to expose the uptake of the VLE in a relational and holistic manner. There is a need to explain the uptake through this lens because everyday practice is configured and reconfigured by multiple meanings and materialities (Suchman 2007). Consequently, sociomateriality reinforces that considering organizational practices technology is not only important during implementation, but also when considering people performing their daily tasks.

### Sociomaterial Imbrication and Design

Apart from exposing the uptake of VLE through sociomaterial entanglement, this research attempts to explicate design considerations of the VLE. However, the concept of entanglement, due to its ontological commitment to the inseparability of the social and material, limits our view of redesigning systems to improve them because they are viewed as entangled and cannot be rearranged. Sociomaterial imbrications must be considered for design orientation because they “provide more possibilities for imagining design-oriented action and more opportunities for envisioning changes to technologies and organizations” (Leonardi and Rodriguez-Lluesma 2012). Along this line, this research intends to integrate the perspective of sociomaterial imbrication to explicate design considerations of the VLE. This perspective is appropriate when considering design orientation using a sociomaterial lens as it focuses on generating insights into how to improve the technology apart from describing organizational circumstances (Hevner et al. 2004 as cited in Leonardi and Rodriguez-Lluesma 2012). The focus on materiality will help surface the significance of the technology towards practices and to understand how using technology differently might improve people’s lives. Design considerations in this context is not purely focused on altering to improve the technical design of the VLE but will include social, organizational and cultural factors.

### CONCLUSION AND FUTURE DIRECTIONS

This paper presents a review of different key perspectives in the design considerations of virtual learning environments in developing countries. There are three key perspectives evident in e-learning studies in developing countries; namely, culture, human behaviour towards technology, and organizational influences. Although these perspectives exhibit analytical power in examining the benefits of e-learning, less has been explored to comprehensively clarify the heterogeneous relations that often blur the influence of material artefacts

over educational practices (Fenwick and Landri 2012; Sørensen 2009). As such, we propose a sociomaterial perspective for investigating design considerations of virtual learning environments in higher education institutions in developing countries. The framework introduces the concept of entanglement to understand the uptake of the educational technology by looking into the emergence and the relationship of artefacts, people and the environment. Likewise, sociomaterial imbrication is introduced to focus on the design orientation, which is important in understanding design considerations of the VLE. According to Leonardi and Rodriguez-Lluesma (2012) imbrication provides a room for action and changes to technologies and organization without compromising the sociomaterial structure of the organization.

Furthermore, this paper presented a novel research direction in the area of educational technology in developing countries by introducing a new perspective to understand and explain the complex phenomenon. The sociomaterial perspective highlights the realistic view of everyday mangling of technology, people and their environment. This approach may find merit in the improvement of e-learning services in the chosen tertiary education institution or similar context. The proposed framework will be utilized as a basis to conduct an in-depth study on virtual learning environments in a selected higher education institution in the Philippines as a pilot case. This future study will be qualitative in nature employing case studies to answer the “how” and “why” questions earlier posited.

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