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BRING-YOUR-OWN-DEVICE (BYOD) IN THE UNIVERSITY SECTOR: AN INTERPRETIVE CASE STUDIES APPROACH

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Abstract

This paper presents initial result of on-going research into Bring-Your-Own-Device (BYOD) in the university sector as a means to discuss an inductive interpretive methods in information systems. It discusses the interpretivist view in information systems qualitative research and why it is chosen as the approach for this research. Explaining the ontological stance and subsequent epistemology, it contrasts positivist study and interpretivism. Multiple case studies are presented from the use of interviews and field observations. Following an iterative grounded process, it presents some interpretation of the interview transcriptions and shows how observation field notes can help support the interpretation towards the emergence of a grounded theory. Finally, the paper discusses interpretative theoretical frameworks: Actor Network Theory (ANT), Sociomateriality and Performativity to explore how such frameworks can be operationalised for on-going data collection and analysis.

Keywords: BYOD, Qualitative research, Interpretive case study, ANT, Sociomateriality, Performativity

1.0 Introduction

This research examines Bring-Your-Own-Device (BYOD) using Higher Education as the setting. BYOD is where people adopt and manage personal information and communication technology (ICT) devices to get connected to campus networks. This is a digital ecosystem defined as “a self-organising digital infrastructure aimed at creating a digital environment for

networked organisations that supports the cooperation, the knowledge sharing, the development of open and adaptive technologies, and evolutionary business models” (Uden, Wangsa, & Damiani, 2007). Entering an era of increasing usage of digital technology, it is necessary to identify the significant players or stakeholders: the providers and users of information technology, both human and non-human actors such as academic staff, non-academic staff, and students, as well as the technology itself. The terms for the players or stakeholders of BYOD in this paper are used similarly to describe actants in the context of actor-network theory (ANT) association as well as in the sociomaterial context. To view this structure, students are identified as the specialist users with their own personal devices. They are the main players of BYOD, therefore, the way in which campus networks are configured and in which the providers of education respond and facilitate the provision of media education tools such as BYOD is of concern. It concerns the extent to which, and how quickly, university structures act to enable demands for these emerging digital ecosystems. This leads to the identification of a research problem area that may be stated as:

Is BYOD welcomed by stakeholders on all sides in the Higher Education sector?

To what extent is this “welcome” analogous to its “welcome” in other sector?

These questions will then guide our understanding of the consumerisation of information and communications technology which are framed as BYOD in the university sector.

This paper is designed as follows. Section one provides the introduction of the paper, followed by section two that explains the research processes guided by the identification of the ontology of the phenomena of interest determining the epistemology and research methods that will be deployed. Section three elaborates the way that this research is to be carried forward comparing the approach taken, to approaches used by other researchers. It discusses the appropriateness of the methods that will be utilised in achieving the research goals. Section four and five proceeds with the pilot case study and presents initial result of the first case study, named as *Case1*. It is also structured in section six describing the philosophical underpinnings of the research pertaining to the area of study it contributes to, being as actor-network theory (ANT) (Michael Callon & Law, 1997; Fenwick & Edwards, 2011; Latour, 2005), sociomateriality (Cecez-Kecmanovic et. al, 2014; Leonardi, 2013; Orlikowski & Scott, 2008) and performativity (Law & Singleton, 2000) as theoretical frameworks interwoven in this area of research. The paper ends with a conclusion to summarise the entire work in this paper.

2.0 The epistemology and ontology

Interpretive research is widely deployed in the information systems field. Various discussion pertaining to qualitative research are available (D. M. Myers, 1997; M. D. Myers & Avison, 2002; Orlikowski & Baroudi, 1991; Walsham, 1995). However, the discussion are not intended to displace the positivist approach with the critical interpretive methods (Orlikowski & Baroudi, 1991). This paper will detail the steps taken in consideration of the research design starting with the discussion of this research’s ontological and epistemological position through an interpretive qualitative approach.

Epistemologically this research will investigate the existence of BYOD. It will take an inductive approach to understand the meaning of BYOD and its implementation through the review of literature. The review will cover similar studies carried out by other researchers. An interpretive process will be carried out in order to understand how BYOD is implemented in the university sector. Furthermore, the investigation continues to explore whether the uptake

of this phenomenon contributes to opportunities or threats to network security and user satisfaction.

While the focus of this research is on the relationships and interactions between the various actors i.e. the IT services personnel, academic staff and students, and the devices, it is critical to understand how various actors perceive and experience the use of the ICT constructs in their teaching and learning. The ontological stance is that these relationships and interactions are socially constructed. In order to focus its findings, this research will also seek to explore the ways BYOD is deployed in the industrial sector by means of literature review. Actor-network theory (ANT), complimented by a sociomaterial perspective and analyses seeking performativity will be applied and seek evidence pertaining to societal reactions to technology.

As this research aims to look inductively into the practice of BYOD in the university sector, there is no precise pre-defined hypothesis made with regard to this phenomenon other than the problem area identified above. The research is interpretive in nature and it employs an inductive approach because it seeks to examine complex phenomena such as the risks posed to users and providers of disruptive technology which some claim to be an enveloping ecosystem displacing former structures. Case studies will be carried out to investigate the extent of this displacement evaluating the power mechanisms played out in the performance of the demand for and facilitation of the BYOD phenomenon. This is contrary to positivist study which would involve hypotheses testing with measurable or countable instances of precisely stated and observed phenomena (Orlikowski & Baroudi, 1991). In order to understand phenomena that is essentially about the role of ownership of technology in the performance of teaching and learning, ontologically as a social construct, it is appropriate to deploy inductive interpretive methods. A method for data analysis has not yet been precisely determined, however, it is likely that this research will follow an inductive grounded approach (Corbin & Strauss, 2008) to iteratively seek phenomenological evidence, observing the micro-power driven performance (Law, 1992) amongst the users and providers all the while holding an holistic sociomaterial approach (Orlikowski & Scott, 2008).

The inductive approach helps to disentangle the meanings that individuals construe about the things in the performance through social interaction. An inductive process attempting to emerge categories, axioms and theory (Glaser & Strauss, 2009) from stakeholder's perspectives will be developed and modified as an interpretive process (Boland 1979, p.260 as cited in Orlikowski & Baroudi, 1991). This process will lead to understanding by observing the situations where students, the academic staff and non-academic staff perceive the use of technology on campus and enquiring into how these technological artefacts influence them. The explanation of the social interaction will be developed through an interpretive processes concerning the micro-powers of the actors and actants (the BYOD devices). Orlikowski & Baroudi (1991) argue that positivist approaches would not be useful in order to understand meanings. To grasp a clear picture of what interpretive research is, Orlikowski & Baroudi (1991, p.5) give the definition as "interpretive studies assume that people create and associate their own subjective and intersubjective meanings as they interact with the world around them. Interpretive researchers thus attempt to understand phenomena through accessing the meanings that participants assign to them." Interpretive scientists accordingly endeavour to comprehend human thought e.g. motivations, attachments and subscriptions, and activity in social and hierarchical settings, creating profound elements of knowledge into information systems phenomena (Klein & Myers, 1999).

3.0 Research Approach – Interpretive Case Studies

The use of qualitative case studies is a well-established approach in the study of information systems (Kaplan & Maxwell, 2005), and studying a transformation of interest from technological to a more managerial perspective (Benbasat, Goldstein, & Mead, 1987).

The strength of applying case study in information systems research is that case study will extensively apprehend the actual phenomenon as it is looking at actual relationships in single and multiple organisations. Studying in the actual setting will incorporate the most recent feedback and insights of a particular phenomenon and is useful in generating research theories (Benbasat et al., 1987; Galliers, 1991). It also produces rich and meaningful data as it analyses more variables as compared to other approaches (Galliers, 1991). This study will utilise multiple interpretive case studies (Walsham, 1995) in the university sector to investigate whether the BYOD phenomenon contrasts with its use in different situations. The outcome from multiple case studies is viewed as more convincing and the general study is viewed as being more vigorous than single case study (Herriot & Firestone, 1983 as cited in Yin, 2009).

The research will initially take an inductive approach - gathering data from campus IT Management and technical support staff, the lecturers and end-users (the students) both in the UK and Malaysia. It involves the interactions and affectiveness amongst actants both human and non-human. In order to understand how the participants assign meaning to and view this phenomenon, the research requires an in-depth case study approach. For instance, BYOD practice popularised by Intel in 2009 (Burns-Sardone, 2014) along with the wider concept of IT consumerisation (Moschella, Neal, Opperman, & Taylor, 2004). Popularity grew both in industry and education. As a result, the phenomenon has been rapidly debated in articles and journals, – academic and non-academic. However, this technology's uptake seems to be more promising in the industrial sector as an option to reduce operation cost (Burns-Sardone, 2014). In contrast, the number of instances is relatively small in the higher education sector. This technology and its user community appear to exist in a shared context in the sense used by Nonaka & Konno (1998), who refer to '*ba*' where "as a shared space for emerging relationships". Having said that, the growing interest opens up an avenue for this research to shine new light on understanding this situation in 'space and time' knowing that this phenomenon can be explicitly explored inductively by in-depth case studies. As previously explained, these case studies seek to examine the relationships and interactions amongst human and non-human actors, from which emerges a complex network which will be viewed and explained through the lenses of ANT, and performativity with a sociomaterial stance.

4.0 Pilot Case Study

The first stage of this research has been carried out at the Department of Computer Science and Information Systems (DCSIS) and the Department of Management at a UK university by utilising a pilot case study (Yin, 2013) for investigating BYOD in the university sector. This research aims to understand the consumerisation of ICT that introduced the BYOD phenomenon into the university sector. In particular, this pilot has been initiated to explore the department's current systems, its support for staff and students, and to elicit some insight into BYOD implementation. Pilot interviews were conducted to discover the views and empathy concerning emerging technologies, and BYOD among participants, and also, the extent to which the participants are aware of this construct. The participants include the Systems Manager, two lecturers and four students in the DCSIC and the Department of Management. Formal and informal semi-structured interviews were carried out. Four interviews were tape-

recorded and were transcribed verbatim. Two interviews were carried out on a casual occasion and field notes were recorded.

5.0 Case Study 1 – Case1

Whether or not this research is worthwhile is something that the pilot case study will tell and it highlights the lessons learned from its series of interview sessions (Yin, 2013). The interviews are designed to explore the research problem area (Kvale, 2008). The interviews were supported by class observations to find out the extent of use of personal devices for teaching and learning purposes in the classroom and computer laboratories. It is rendering evidence in the problem area identified by the question - *Is BYOD welcomed by stakeholders on all sides in the Higher Education sector?* The case study differentiates the use of personal devices in lectures such as in classrooms and computer laboratories. Data is gathered from three different perspectives, the university Information Technology Services (ITS) director, a teaching assistant/demonstrator – demonstrating a programming module in a computer laboratory, and a part-time undergraduate student who attends both lecture and lab modules. In supporting the findings, two class observations have been conducted with the awareness of the tutors. The data collection methods i.e. interview and observation are complimenting each other to reduce biases inherent from a single method (Corbin & Strauss, 2008; Maxwell, 2012).

5.1 Case Study 1 – Interviews

Qualitative research in social science studies is carried out with the purpose of understanding a specific phenomenon – the interaction between people in a chosen setting or “a meaning of an experience” and cultures (Kaplan & Maxwell, 2005; Merriam, 1988). The interview data is rich with meanings about people’s experiences, perceptions, opinions, feelings and knowledge and it may be considered and documented (Bryman, Bresnen, Beardsworth, & Keil, 1998; Fontana & Frey, 1994; Holstein & Gubrium, 1997; Martin & Turner, 1986, as cited in Alvesson, 2003). The responses, insights and views from the interviewee describe one particular phenomenon in more depth.

The following shows part of the data analysis from the three identified actors. Semi-structured interviews were carried out. The findings suggest how they interact and view BYOD constructs in the process of teaching and learning. This section is not meant to comprehensively discuss the whole research findings. However, it leads to understanding of the identified research approach in relation to what has been discussed earlier in this paper. This case study is still on-going and planned to be completed soon. It should be noted that the data analysis techniques will not be discussed in this section. It will only discuss preliminary interpretations based on the interviews and observations.

The interview with the university ITS director lasted for about 1 hour and 30 minutes and was tape-recorded. The interview was transcribed verbatim. For both interviews with the teaching assistant and the student, the interviews were carried out without tape recording. It was found time consuming and inefficient to transcribe the interview transcript word-by-word (Kvale, 2008; Markle, West, & Rich, 2011). Therefore, after a first attempt at recording, handwritten note taking was used. Transcribed notes were prepared and emailed back to the respondent for validation and verification (Miles & Huberman, 1994). Three interview protocols were designed to guide the interview session. The questions prepared were different based on the respondents’ position and experience, though many questions appeared on several protocols.

After a brief introductory session, the interview kicked off with a question regarding their awareness of the BYOD acronym.

The interpretation from this question alone shows that not all actors in the university are fully aware of the construct. Previous pilot case study reported that there was a lecturer who has not seen the acronym BYOD before (Wan Ghani, Wilson, & Sims, 2015). However, this is not the main question. After the interviewer gave an explanation about the phenomenon by showing some diagrams, the student responded as *“I’m aware of the phenomenon. Furthermore, I have done it already and the practice is not new. I have seen students bring their own device few years back”*. Similarly, the ITS director said that *“Bring personal device has always been there. We’ve seen it happened before.”* He added *“...with current mobile environment, obviously the frequency is increasing”*. The results are summarised in Table 1.

Question	Respondents	Heard about BYOD acronym before?
i.	ITS Director	<i>“Yes”</i>
ii.	Teaching Assistant	<i>“Yes, I have seen it and read a few articles about BYOD.”</i>
iii.	Student	<i>“No, I’ve never actually heard the acronym before...”</i>

Table 1 “Heard about BYOD acronym” question result

While for a teaching assistant, he is actually aware of this phenomenon and did read the highlights about BYOD in some articles. He also said that there are some universities which have already moved into this BYOD initiative. Based on the above, it can be concluded that there is nothing new about bringing personal device to the campus environment. It has already been happening in the past. Students have been bringing their own device in the university.

Then, there is a question which was only asked for teaching assistant and the student to see the existence of BYOD phenomenon in the classroom. The following table shows their response – Table 2.

It can be induced that there are students who bring their own device i.e. smartphone, laptop computer and tablet in the classroom but they prefer to use the facilities provided by the university. On the lecture in classroom settings, although some students use their personal device during the lecture, most prefer to write their notes on paper: a traditional face-to-face lecture practice.

On the other hand, in response to the question regarding the university preparation to support this BYOD practice, some replies were as on Table 3.

Respondents	Question
i. Teaching Assistant	<ul style="list-style-type: none"> • Students using their own device in the computer laboratory/ in the lecture/ • How do you think devices are being integrated/used into the classroom and what are the learning experiences? <p><i>“I would say that out of 50 students, only 2-3 students. I saw the students are using different operating systems as well, for example Linux, Macintosh and Windows. It will take time for me to demonstrate the programming lesson on various platform on the students’ personal device”.</i></p>
ii. Student	<p><i>“Yes, of course yes! They do. The students actually use their own device for both learning and entertainment. Some students record the lecture using their smartphone. There are cases where for example, when the lecturer writes something on the whiteboard, (pause) some information which is not included in the lecture slides, then I saw some students taking screenshot of the writings on the whiteboard. They hardly write it on paper, they digitalised it as images. Some students also use their devices to type the lecturer’s explanation like (taking notes) immediately on their laptop where they don’t bring the printed slides to the classroom.... However, most students prefer hand-written note taking”</i></p>

Table 2 “use of own devices” question results

Respondents	Question
iii. ITS Director	<ul style="list-style-type: none"> • Current setup and operation of the university. • With regard to BYOD, how IT service can support in teaching and learning purposes <p><i>“...our focussed is very much in terms of making all the applications and mmh software are available to the offsite students ...”</i></p> <p><i>“... students come here for the evening teachings and they have got a limited amount of time to spend here.. so they need to access their teaching materials, discussing groups, communications and so forth, when they are at work or at home. so a lot of focuses in terms of enabling that mmhh so we got a virtual private network...”</i></p> <p><i>“... Teaching Enhanced Learning.. so thats very important components of what we do.. so we’ve got a team who look after a virtual learning environment which is moodle at the moment...”</i></p> <ul style="list-style-type: none"> • “How do you see the drive for this phenomenon among the students and the lecturers?” • How do you go about considering full BYOD setup in the university i.e., reducing the provision of desktops in the laboratories)?” <p><i>“... there is no discussion about implementing this setup in the board meeting... “</i></p> <p><i>“no... not very soon, not in 5 years...”</i></p>

Table 3 “the university preparation to support BYOD practice” research question results

In large organisations, BYOD means staff bring their own device and use them both personally and for work. This leads to a reduction of the provision of desktops by the companies and may therefore reduce operating and maintenance costs. However, in many education sectors, it seems impossible to reduce the number of labs or desktops. The interpretation that can be made here is that *Case1* doesn't see this phenomenon as a way to reduce the provision of desktops to the students and it is very unlikely to transform to complete BYOD setup in the near future. The university provides the facilities to support BYOD practice such as the connection i.e. eduroam, customisation of the website interface and other systems to support viewing through mobile devices and Virtual Private Networks (VPN). However, looking into the nature of teaching and learning in this university which is focusing on face-to-face learning, the utilisation of BYOD practice is not considered urgent.

5.2 Case Study 1 – Observation

Apart from the interview, field observation is used to support the analysis (Maxwell, 2012), observation is one of the primary data collection techniques in qualitative research in fieldwork settings to understand the participants' behaviour and their interaction in the real life setting. The observations act as a separate entity observing the situation as a non-participant or the researcher can also become part of the situation as member of a group or setting with or without the knowledge of the group being observed (Corbin & Strauss, 2008). So there is a distinction between overt and covert observation respectively. Solid understandings of the phenomenon that the researcher is investigating can be gained using multiple methods, can also reduce biases (Maxwell, 2012).

For this research, non-participant observations were conducted on two separate occasions covering an evening part-time class and a full-time class in the afternoon. Both were carried out with the lecturer's consent. This section provides the interpretation made for one class observation. During the observation, the students were observed from the last row of the seating. Each observation lasted for about an hour and was manually recorded in a notebook. Field notes were prepared right after the observations. The module doesn't require the use of computer applications and the lecture was conducted as a traditional face-to-face interaction where the lecturer delivered the lecture using a projector to project the material. Students were also allowed to ask questions during lecture. The following shows the interpretation.

Date : 11th November 2015 (Wednesday)
Time : 19.35 – 20.45pm

Class situation before the lecture started

*There were 25 students sitting on the left row and 23 students on the right row. Before the lecture started, some students were seen to be engaging with their personal device. There were approximately six laptop computers, two tablets and some mobile phones on the students' desks. The **module instructor** was preparing to project slides using his laptop computer. The teaching desktop was remained idle.*

Students' (with and without personal device) interaction with the device and the lecture

As the lecture moved on, most of the students were using pen and paper to jot their lecture notes and they seemed to be paying attention to the lecture. Mostly with lecture printed slides. However, there was keyboard typing sound every now and then, and two students were actively and constantly typing lecture notes on the laptop. Twenty minutes after the lecture started, 2 students used their smartphones

to navigate social media and started texting messages. Most of the students did not use their own devices for this teaching and learning purposes.

The researcher has not yet conducted class observation on a module which requires the utilisation of a particular software in the computer laboratory. Therefore, there is a limitation to see how both interview and observation complement each other for that nature of learning. For that reason, class observation for the modules which required the use of computers will be carried out soon. It should also be noted that the data collection and interpretation is not intended to investigate students' behaviour in the classroom towards the lecture.

6.0 Theoretical frameworks

With the present human-technology interaction in the technology and social environment, social science scholars have set forward theoretical frameworks to study a particular phenomenon. The following section briefly discusses three theories which are to be considered to analyse the research findings.

6.1 Actor-Network Theory (ANT)

Applying an actor-network theory (ANT) framework is useful in this type of research as this research is viewed as a socio-technological study which associates humans and technology. It makes more sense for this research to apply ANT to disentangle complex relationship between human and technology in its normal course. Identifying actors i.e. the students, academic and non-academic actors, the ICT artefacts: BYOD will trace the 'sociology of translation', essentially looking at the building of relationships between them (Michel Callon, 1986). Latour (2005) suggests that social interaction among actors creates 'social ties' and 'association', which are both different. Social ties are often fragile. ANT looks at the association among actors as 'a movement', 'a displacement', 'a transformation', 'a translation' and 'an enrolment', which then create a strong 'network'. In dealing with the emergence of technologies, multiple case studies will be applied by looking at the relationships and interactions between human actors and non-human actors the chosen research settings.

6.2 Sociomateriality

Following the extensive discussion on social-technical systems (STS) (Mumford, 2006) and actor-network theory (ANT), Orlikowski (2007) coined the term sociomaterial further looking at the fundamental associations between human and material actors, mixing both actants: people (social) and technology (material) (Cecez-Kecmanovic et al., 2014). According to (Orlikowski, 2007), systems composed of human and non-human actors are inseparable and must be viewed holistically. For example, based on the *Case 1* partial findings, some students are using their personal device in the classroom although the module does not require them to bring any. However, in this case, the majority of the students are seen to take note using earlier technology. Therefore, it is worth investigating this situation to explicitly resolve whether or not there is some element of rejection. In addition, Fenwick (2010) emphasises to "re-think material practice" in the social mixing and heterogeneous settings. In particular, sociomateriality is used to complement ANT and it is expected that a grounded theory may emerge.

6.3 Performativity

Performativity of BYOD in the university sector will be viewed as the ‘enactment’ (Orlikowski & Scott, 2008). The epistemology and ontology of this research have been identified and it highlights the actual phenomena which is BYOD. This ontology will then be examined in connection to people’s acceptance towards this emerging digital ecosystem and the association between human and technological actors and actants. This research is estimated to take at least four full case studies after the pilot: two case studies will be chosen from the United Kingdom and two case studies from Malaysia. These will compare the performativity of humans and non-human actors in both countries in the context of the use of BYOD. Law & Singleton (2000) asserted that performativity can be understood by looking at the interaction amongst human and non-human actors’ “*hybrid performances*” where the differentiation between the social and the material is viewed through their performance. Therefore, this researcher would like to go about looking at the performativity amongst those identified actants whilst performing of BYOD.

7.0 Conclusion

This paper has sought to justify the suitable philosophy, approach and methods for conducting this research. The choice is clearly made after analysing and comparing with other available methods in this type of qualitative study. It does not critique positivist stance but rather demonstrates through the pilot case study the veracity of the approaches and lenses selected. The implementation of the interpretive case study approach is laid out in Case1 through a series of interviews and supported with the class observations. This paper does not present the entire findings about the case study as it is still on-going. However, it presents interview transcriptions and shows how interpretations are made based on the chosen research approach. In addition, Actor-network theory (ANT), sociomateriality and performativity are justified as the theoretical pyramid of the investigation.

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