Design and Analysis of Bring Your Own Device (BYOD) Pedagogies in Higher Education

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Abstract—This paper reports and discusses the findings from a study exploring the use of Bring Your Own Device (BYOD) for teaching and learning at a university in Hong Kong. Seventy-one undergraduate students enrolled on an English course participated in the study. A pedagogical framework is proposed to guide the design of BYOD-mediated lessons, and the potential of BYOD pedagogies to support teaching and learning is examined. Learning gains from BYOD-mediated lessons are reflected in students’ assessment results. Some merits and challenges associated with BYOD-mediated learning are emerged from students’ focus group responses. The findings contribute to an expanded understanding of the BYOD experience across educational settings.

Index Terms—bring your own device, pedagogy, technology, teaching and learning, higher education

I. INTRODUCTION

The prevalence of mobile devices and a growing appetite amongst young people for access to digital resources have given impetus to an initiative in the education sector in recent years to encourage students to bring their personally owned devices to class for learning [1]. The notion of “Bring Your Own Device” (BYOD) has its origins in the corporate community. In 2009, the Intel Company discovered that its employees had frequently used their own devices such as laptops, smartphones, and tablet computers, at work to access corporate information, resulting in productivity increase and cost savings. Since then, the BYOD approach has been widely adopted by those in business and in education [2]-[4].

The pedagogical use of BYOD refers to the situation where students bring their own digital devices to school for different learning purposes [1], [5]. It involves the utilisation of movable devices to access multimedia resources and/or to participate in online communities for learning, helping to create an optimal learning environment where personalised self-paced learning can take place across multiple spaces and time scales [6]. Students can pursue individual learning pathways to meet their specific learning needs [7]. The perceived value of BYOD for education was confirmed, for example, by a pilot study involving a number of secondary schools in Canada some years ago. Their findings noted that a BYOD approach had the effect of dismantling the border between in- and out-of-class activities, thereby opening up new vistas for learning [5].

The BYOD study reported in this paper is innovative and significant in that efforts to examine the potential of BYOD pedagogies to support teaching and learning are relatively recent, and research that scrutinises this to date, especially in higher education, has been limited. The findings from the participating institution—the Hong Kong Polytechnic University (PolyU) – have contributed to an expanded understanding of the BYOD experience across educational settings.

II. CONTEXT

In the academic year 2015/16, a total of 71 PolyU students enrolled on the ELC1014 Advanced English for University Studies course gave their written consent to participate in the BYOD study. ELC1014 is a credit-bearing subject that requires students to research for, write, plan and revise a 1200-word academic position argument essay, and to defend their views and engage with those of others clearly and logically in a mini oral defence.

The participating students came from five class groups and four academic disciplines: Accounting and Finance, Design, Nursing and Radiography. As shown in Table I, three class groups (38 students) were randomly assigned to the experimental group while the remaining two groups (33 students) were assigned to the control group. In ELC1014, the experimental group was provided with opportunities to explore and learn with various eResources and to interact with peers and the course instructor using their own devices in class, while the control group was not. There was no significant difference between the two groups in the results of the English language public examination at the outset of the study.

<table>
<thead>
<tr>
<th>Group Type</th>
<th>Programme of Study</th>
<th>No. of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Accounting &amp; Finance</td>
<td>15</td>
</tr>
<tr>
<td>E</td>
<td>Design</td>
<td>6</td>
</tr>
<tr>
<td>E</td>
<td>Radiography</td>
<td>17</td>
</tr>
<tr>
<td>C</td>
<td>Radiography</td>
<td>24</td>
</tr>
<tr>
<td>C</td>
<td>Nursing</td>
<td>9</td>
</tr>
</tbody>
</table>

TABLE I. THE EXPERIMENTAL (E) AND CONTROL (C) GROUPS

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III. PEDAGOGICAL FRAMEWORK

Based on the benefits of BYOD identified from the literature [1], [3]-[5], a BYOD-supported pedagogical framework is proposed to highlight the characteristics of BYOD and to guide the design of BYOD-mediated lessons. The framework is characterised by features for learning and for teaching, as illustrated in Fig. 1. For learning, BYOD can provide students with enriched opportunities featuring the following elements (M-U-S-I-C):

- **Multimodal**: students can easily access different types of learning resources such as videos, audios, PDFs, Webpages, and etc.
- **Ubiquitous**: students can easily learn anytime and anywhere.
- **Student-centred**: students can easily set their own learning pace by choosing what to learn and when to learn.
- **Interactive**: students can interact more with their teachers, with peers and with learning content.
- **Collaborative**: students can easily share learning resources and exchange ideas with each other to co-construct knowledge.

For teaching, BYOD can benefit teaching in the following ways (T-O-P-I-C):

- **Teacher-facilitated**: teachers can facilitate students to learn rather than just tell students what to learn by direct teaching.
- **One-to-one**: teachers can easily understand students’ learning progress by instant feedback. This can facilitate one-to-one teaching without publicly singling out students.
- **Pedagogically-varied**: teachers can easily use varied teaching strategies to deliver different topics of interest and to accommodate different learning styles.
- **Interactive**: teachers can interact more with individual students and with the whole class.
- **Customised**: teachers can easily provide adaptive instruction to different groups of students.

<table>
<thead>
<tr>
<th>Topic: Citation and Referencing</th>
<th>Duration: 60 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning Objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>i. Use appropriate citation styles in their position argument essay</td>
<td></td>
</tr>
<tr>
<td>ii. Use appropriate citation techniques - quote, paraphrase and summary – to refer to sources</td>
<td></td>
</tr>
</tbody>
</table>

**Table II. A BYOD-Mediated Lesson Plan**

<table>
<thead>
<tr>
<th>Learning (M-U-S-I-C)</th>
<th>Teaching (T-O-P-I-C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborative</td>
<td>Teacher-facilitated</td>
</tr>
<tr>
<td>Student-centred</td>
<td>Customised Interactive</td>
</tr>
<tr>
<td>Multimodal</td>
<td>Teacher-facilitated</td>
</tr>
<tr>
<td>Student-centred</td>
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<td>Multimodal</td>
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</tr>
<tr>
<td>Ubiquitous</td>
<td>One-on-one</td>
</tr>
</tbody>
</table>

*Internet, mobile applications, cloud-based platforms
**Audio, video, reflective writing, artefacts, blogging systems, unit test with instant feedback; student response system, e.g., Jeopardy*
IV. DATA COLLECTION AND ANALYSIS

A. Course Assessment Data

To evaluate the impact of BYOD on achievement, the assessment results of the experimental and control groups were compared and analysed. Only students from Radiography involved in both groups were selected to ensure consistency in language proficiency and marking standardisation. The assessment weighting and criteria for the three assessments used for comparison are outlined in Table III.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Overall Assessment Weighting</th>
<th>Assessment Criteria</th>
</tr>
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<tbody>
<tr>
<td>A1: 600-word draft essay</td>
<td>20%</td>
<td>Content (30%), Organisation (20%), Language (30%), Referencing (20%)</td>
</tr>
<tr>
<td>A2: 1200-word final essay</td>
<td>45%</td>
<td>Content (30%), Organisation (20%), Language (30%), Referencing (20%)</td>
</tr>
<tr>
<td>A3: Mini oral defence</td>
<td>35%</td>
<td>Content (20%), Delivery (30%), Language (30%), Pronunciation and fluency (20%)</td>
</tr>
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B. Focus Group Interview

Three focus group interview sessions were held with a total of 10 students, randomly selected from the experimental group. All interview sessions, each lasting approximately 45 minutes, were audio-recorded and subsequently transcribed verbatim using NVivo. Such data were used to understand students’ views on the use of personally owned devices for learning. The interview protocol consisted of four guiding questions:

- Can you describe the course where you used your own device? How is it different from the courses where you were not allowed to use your own device?
- How did you use your own device to learn in the course?
- What changes (in terms of learning attitude, efficiency, interaction and etc) do you see in yourself brought about by using your own device to learn?
- What changes do you see in your classmates’ behavior brought about by using their own devices to learn?

V. IMPACT OF BYOD ON LEARNING ACHIEVEMENT

Fig. 3 to Fig. 5 show that the experimental group (denoted by solid line with squares) outperformed the control group (denoted by solid line with triangles) in nearly all four stated assessment criteria across the three assessments, except in the areas of Referencing in Assessment 1, Content in Assessment 2, and Content and Pronunciation in Assessment 3. However, no statistically significant difference was identified in the grades between the two groups, apart from Language in Assessment 1, suggesting that the experimental group performed significantly better than the control group in language in the draft essay.
B. Engagement and Interaction

Use of personal devices can promote student participation and interaction between teachers and students, as the findings suggest. The in-class activities such as paragraph writing practice and giving comments on the Padlet (see Fig. 2) have made learning interesting and competitive. More importantly, such activities give voice to students, especially those shy and reserved ones. The following quote illustrates this point:

“Well, I think it’s useful, because...when I was in my secondary school I was so embarrassed that I did not dare to raise my hand and answer in front of the whole class. So it’s easier to express my opinion now.”

Student-student interaction is easier and more frequent because of the personal devices. Several students reported that using file sharing applications such as GoogleDrive enabled them to not only share documents for the mini oral defence, but also hold synchronous online discussions and edit the presentation slides together. The availability of the abundant learning resources seems to foster peer support. As a student observed,

“When I encounter some kinds of difficulties in my learning...my friend referred to YouTube videos and said, ‘just watch them, you will understand better.’”

C. Individualised and Independent Learning

As students carry their personal devices around, learning becomes more personalised and independent. A student reported using Google to look up unknown words or concepts during lessons, rather than asking the teacher during or after class. Also, the online discussion and peer feedback activities motivated students to pursue some research on their own, as many students confirmed. The readily available online learning resources made it possible for them to explore and consolidate their understanding of a topic without teacher assistance. This point is supported by the following quote:

“I think there are many online resources that can help us to learn how to write an academic essay, e.g., the academic Phrasebank provides some vocabulary or sentence structures that can help us to become familiar with the style of the writing. And also there may be some online exercises that are not covered in the lesson, but we can access them ourselves through the Internet.”

A few students expressed appreciation for the online learning exercises which allowed them to check the answers themselves rather than having to wait for the teacher’s explanation. This facilitates learning according to the student’s own pace and need. As a student said,

“You can check instantly whether your answer is correct, but for paper work we may need to wait for the tutor to tell you the answer.”

VI. STRENGTHS OF BYOD PEDAGOGIES

A. Accessibility and Efficiency

Most of the students appreciated the convenience of accessing learning materials and Internet-based resources for learning using their own mobile devices, without having to carry the heavy lecture notes around, or visit the library in person to look up books or other print-based materials. They also found it easy to conduct searches on the internet. Some students reported the smartphone applications were easily available and user-friendly for learning while on the go, as shown in the quote below:

“I will download all the psychology presentation to my smartphone so that I can check them and revise when I'm travelling around.”

Many students said that they could complete the assignments more quickly and efficiently with the use of their own mobile devices: searching for academic articles, editing the reference list, conducting keyword searches, using different search engines such as Google Scholar and the library’s OneSearch. The online spelling and grammar checker had also made proofreading easier, as pointed out by several students. Some used the referencing machine to compile the reference list. Having access to their own of electronic devices thus makes learning ubiquitous, thereby increasing learning efficiency. As a student shared,

“When the deadline is close, I will use my portable device like my laptop. When I was travelling I will type my documents and try to speed up the progress.”

B. Distraction and Computer Skills

Distraction and computer skills are the primary concerns about using electronic devices for learning. While some students conceded materials not related to learning, such as pop-up messages and promotional videos, are inevitable on the Internet and could diminish attention, especially during lessons or while working on...
assignments, others countered by recommending self-discipline to maintain focus. One student also argued that mobile devices could provide welcome diversion to lessen the stress induced by long lectures.

A few students who were not used to or less confident in typing on the computer showed reluctance to use electronic devices in class. Instead, they would write notes on paper or in the print-out copies. Several also expressed feelings of confusion in their attempts to navigate the different interfaces and identify relevant information.

B. Internet Connectivity and Classroom Furniture

Internet connectivity and digital inequality are also identified as a source of worry. There may be spots where Wi-Fi connections are weak or blocked, causing the computer to slow down. A few students noted the limited number of power sockets in the classroom, which often compelled them either to scramble for seats near such sockets, or to face the prospect of dead batteries during the lesson. In some classrooms, chairs with writing tops are not sturdy enough to support the weight of a laptop or designed in a way that facilitates in-class activities mediated by mobile devices.

VIII. IMPLICATIONS AND RECOMMENDATIONS

Implicit in the findings of this study is that in addition to the learning gains accrued from BYOD as outlined above, institutions can stand to profit in two ways. BYOD practices could ease the need for physical access to multi-media laboratories, which are often fully utilised, given the large student population at the university. Another advantage is that BYOD can be adopted without incurring extra acquisition costs for learners or institutions. To realise the potential of BYOD pedagogy, four recommendations are made.

A. Rethinking the ‘Hit-and-Miss’ Approach

Current practice tends to incline towards a tool-centric view that focuses on technological capabilities, rather than on the effective use of technologies to support language teachers and learners. In other words, the novelty value of a tool can diminish once a newer one is developed for the study should be a helpful starting point. The identified features are not fixed, immutable or static; rather, they are fluid, dynamic and evolving to reflect shifting trends in BYOD practice in different settings and learner populations. The framework signals a pedagogy-centric position by considering the role of technology in teaching and learning.

C. Reviewing the Design and Delivery of Curriculum

The findings suggest the BYOD practice has the effect of destabilising the boundary between learning and social networking, and between in and out-of-class activities. This emphasises a need to create a learning environment unrestricted by the physical confines of the classroom, and by extension, a corresponding need to review the design of delivery of BYOD-mediated subjects.

D. Formulating BYOD Policy and Provide Support

As mentioned above, not all existing classroom furniture and equipment support the implementation of BYOD. At the micro level, BYOD policy can examine effective classroom configurations for optimal BYOD-mediated learning. At the macro level, Special Interest Groups on BYOD can be set up to stimulate continuing discussion and exchange of experience and expertise within the educational community and beyond.

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REFERENCES


Dr. Gary Cheng is an Assistant Professor at the Education University of Hong Kong. He earned a PhD in Computing from the Hong Kong Polytechnic University. His research interests are in eLearning, learning management systems, electronic portfolio, automated systems for teaching and learning, and learning analytics.