Managing In-Lecture Media Use: The Feasibility and Value of a Split-Class Policy

Douglas A. Parry[1*], Daniel B. le Roux[1], Laurenz A. Cornelissen[1]

Abstract High levels of digital media use have become a feature of university lectures. While certainly capable of supporting learning outcomes, studies indicate that, when media use is off-task, it presents as a disruption, distracting both users and those around them from academic tasks. In this study an exploratory, mixed-methods assessment of a media use policy for a semester-long course is presented. This policy divided the lecture theatre into two sections, one for those who wished to use digital devices and one for those who did not. Such a policy empowered students to leverage the value of media, if desired, while affording those who wished not to use media, or be disrupted by their peers' use of media, a degree of protection from distracting cues. Findings indicate that those who consistently selected the same side performed better than those who moved from side to side. Two post-course focus groups revealed that, while having some limitations, the policy was well received by the participants and heightened their awareness of the possible distractions of off-task media use, enabling them to identify and maintain a strategy for their in-lecture attentional allocation and behaviour.

Keywords: In-lecture Media Use, Technology in the classroom, Technology and learning, BYOD Policy**,** Higher Education

1. Introduction

High levels of media consumption facilitated by mobile computing devices like smart- phones, tablets and laptops is a defining characteristic of the current generation of university students (Brooks and Pomerantz, 2017). An important consequence of the affordances of these new media is that they engender a form of behaviour commonly referred to as *media multitasking* — the simultaneous use of multiple forms of media, or the use of media while performing another non-media activity (Jeong and Hwang, 2012). A growing body of evidence suggests that frequent media multitasking is associated with reduced performance on primary tasks and, more significantly, with changes in cognitive control (Ophir, Nass and Wagner, 2009).

Studies of media multitasking patterns among university students indicate that this form of behaviour is also prevalent in academic settings like lectures, practical classes and personal study sessions (Abramova, Baumann, Krasnova and Lessmann, 2017; Author, 2017a). Karnad (2014, p. 18) refers to the use of personal computing devices in academic

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

contexts as *Bring Your Own Device* (BYOD) and argues that, along with games-based learning, learning analytics and MOOCs, it is a key technological trend in higher education.

When students' media use aligns with or supports the academic task at hand, it has been shown to promote learning outcomes (e.g., Berry and Westfall, 2015; Evans and Matthew, 2013; Kong and Song, 2015). However, empirical evidence suggests that the majority of media use instances in academic settings are not related to academic activities in any way, but are of a social, hedonic or affective nature (Parry and le Roux, 2018a; Zhang and Zhang, 2012). Parry and le Roux (2018b) refer to this as *off-task media use* (OTMU) and provide evidence that it presents as a disruption, distracting both users and, in lectures, those around them from the academic task at hand. This proposition is supported by a range of studies performed across multiple countries and academic settings (see Chen and Yan, 2016, for a recent review).

OTMU in academic settings poses an important challenge for learning institutions — both at the level of institutional policy specification, and at the level of presentation where lecturers aim to maximise student engagement and learning. Some lecturers impose restrictive policies while others, in contrast, adopt a passive stance to such behaviour allowing students to use their devices as they deem appropriate (Berger, 2017). A number of researchers have called for investigations of policies that seek an optimal solution which empowers students to leverage the value of media but curb the disrupting effects of unbridled OTMU (e.g., Baker, Lusk and Neuhauser, 2012; Berger, 2017; Flanigan and Kiewra, 2017; Tindell and Bohlander, 2012).

The present article reports on an exploratory mixed-methods assessment of a policy for behaviour in a BYOD lecture. The article commences with an overview of relevant literature before outlining the research design, data collection and analysis. Our findings suggest that the proposed policy, while having numerous shortcomings, provides an effective means of managing OTMU and is perceived as empowering by students.

2. Literature Review

To inform our understanding of in-lecture media use and guide our development of an appropriate policy we reviewed recent research concerning the frequency and associated effects of in-lecture media use, student and lecturer attitudes to in-lecture media use, and policies adopted in this regard. The sections which follow provide an overview of key

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

studies and their findings.

2.1. Frequency and Effects of In-lecture Media Use

It has been widely shown that, for students, in-lecture media use is seen to be a normal and frequent activity (le Roux and Parry, 2017b; Flanigan and Babchuk, 2015). Moreover, it has been shown that such behaviour is associated with diminished academic performance in terms of both lecture/task outcomes and course grades (see van der Schuur, Baumgartner, Sumter and Valkenburg, 2015, for a recent review).

In one of the first studies to consider the frequency and effects of in-lecture media use, Fried (2008) surveyed students, weekly, on their in-lecture media use, finding that 64.3% of participants reported at least one instance of media use per lecture. For those who used laptops, 23% of a given lecture was spent engaging in OTMU. This behaviour was negatively associated with academic performance (both self-reported understanding of course material and overall course performance). Moreover, Fried (2008) indicates that peers' in- lecture media use was reported to be the most distracting aspect of the class, followed by an individuals' own media use. In a later study Sana, Weston and Cepeda (2013) considered the issue of peer effects associated with in-lecture media use through two experiments. In the first experiment the researchers found a significant negative effect of in-lecture media use on lecture-comprehension while, in the second, they found a significant negative effect of visual proximity to a multitasking peer on performance.

Through an experimental procedure Wood, Zivcakova, Gentile, Archer, Pasquale and Nosko (2011) assessed the impact of seven archetypes of in-lecture media use on content comprehension. These included four OTMU categories: (i) texting with a mobile phone, (ii) emailing, (iii) instant messaging, and (iv) using *Facebook*; and three task-related categories: (i) paper-and-pencil note-taking, (ii) word-processing note-taking, and (iii) natural use of technology. Wood et al. (2011) found that participants who did not use any technology out- performed those who made use of some form of technology. The difference in performance, however, was only statistically significant between the *Facebook* and the paper-and-pencil note-taking and between the instant messaging and the paper-and-pencil note-taking conditions. Therefore, while not all in-lecture media use is associated with diminished academic performance, OTMU, especially of a social nature, is associated with decreased lecture comprehension and content retention.

Katz and Lambert (2016) assessed a policy in which students relinquished their mobile devices in each class in

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

exchange for extra credit. Through a quasi-experimental method, the authors found a significant positive correlation between this policy and academic performance. Katz and Lambert (2016) performed a median split, assigning those who relinquished their mobile phones less than the median to a 'below average participation' group, and those who relinquished their mobile phone more than the median to an 'above aver- age participation' group. A significant difference between the groups was found. Over four tests throughout the semester those who relinquished their mobile devices consistently per- formed higher. Upon testing whether this relationship was moderated by conscientiousness or diligence Katz and Lambert (2016) found significant correlations between the rate at which students relinquished their mobile devices and class attendance, cumulative GPA and semester GPA. This indicates that those who normally score higher, scored higher in these classes. Moreover, by virtue of their attendance, conscientious students relinquished their mobile phones more. While possibly providing evidence of the value of restricting access to mobile devices in a lecture, this study does not consider the distractions posed by other media (e.g., laptops), nor does it consider the possible value that such media may provide to their users in a lecture.

The studies considered in this section present a limited sample of studies investigating the prevalence and effects of media use in academic settings. Other studies provide similar results. For instance, the proposition that in-lecture media use is the norm and occurs frequently is supported by studies performed across geographic and socio-economic spheres (e.g., le Roux and Parry, 2017a; Abramova et al., 2017). Moreover, the proposition that such behaviour is detrimental to academic performance is supported by studies which investigated its effects on content-retention (e.g., Dietz and Henrich, 2014; Rosen, Lim, Carrier and Cheever, 2011), test-performance (e.g., Ravizza, Hambrick and Fenn, 2014; Waite, Lindberg, Ernst, Bowman and Levine, 2018), course-grades (e.g., Gaudreau, Miranda and Gareau, 2014; Wu, Mei and Ugrin, 2018), and overall academic performance or GPA (e.g., le Roux and Parry, 2017b; Junco, 2012).

2.2. BYOD Policies

Having considered the frequency and possible effects of in-lecture media use, it is necessary to consider students' and lecturers' attitudes to and perceptions of policies governing BYOD behaviour in lectures. Noting the associations between in-lecture media use and both positive and negative academic outcomes, it is expected that a degree of variance will exist in the extent to which lecturers adopt explicit policies governing such behaviour. Similarly, while

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

students may appreciate the ability to freely use media for both relevant and irrelevant activities, given the associations with diminished performance, it is likely that some may desire strict policies, and others not. McCoy (2013), for example, found that 54% of students favoured policies governing in-lecture media use, but that 91% were not in favour of an out-right ban. Similarly, Tindell and Bohlander (2012) found that 62% of students considered in-lecture media use to be appropriate as long as it did not disturb other students. Berry and Westfall (2015) found that the BYOD policies lecturers implement in response to OTMU are typically perceived by students to be the least effective. Building on this, in this sub-section a number of key studies concerning both lecturer and student attitudes to BYOD policies are briefly considered.

Finn and Ledbetter demonstrate the value of clear BYOD policies in two studies. In the first, policies were considered in relation to perceptions of credibility and, in the second, policies were considered in relation to learner empowerment. Building on relevant literature, Finn and Ledbetter (2013) identified three approaches lecturers adopt in response to students' in-lecture media use: *encouraging*, *discouraging* and *laissez-faire*. Through a survey methodology they compared students' perceptions of these policies to perceptions of lecturer credibility, finding that policies encouraging task-relevant media use related to perceptions of credibility. In contrast, rather than policies discouraging media use, the absence of a clear policy was found to be associated with reduced perceptions of credibility. In a second study Ledbetter and Finn (2013) considered relationships between a lecturer's technology use policies and learner empowerment, finding that encouragement of task-related media use contributed to experiences of empowerment. In particular, the authors found that students hold an expectation that lecturers should allow the use of media for task-related purposes and, when such use is forbidden, empowerment diminishes. Additionally, Ledbetter and Finn (2013) found that vague or unclear policies were a primary contributing factor to disempowerment.

In a study concerning personal and institutional policies, Bayless, Clipson and Wilson (2013) surveyed 55 lecturers on their attitudes to in-lecture media use and the BYOD policies that they apply. Of those lecturers, 75% indicated that specific policies were not mandated or encouraged by their institutions. Given the relative freedom afforded to lecturers in this regard, 47% reported that they included a policy in their syllabi outlining acceptable uses of media in a lecture, while 53% indicated that they did not adopt an explicit policy. Bayless et al. (2013) found that, of those who specified policies, two archetypes emerged: either an outright banning of all in-lecture media use, or media use was only permitted for task-related activities.

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

Through a survey of 146 lecturers across 11 countries Berger (2017) produced a typology of lecturer attitudes to students' in-lecture media use. This typology contains four groups of attitudes*: critical oppressor*, *aware-active, aware-passive, and enthusiast-welcoming*. The first category, critical oppressor, encompassing negative implicit and behavioural attitudes towards in-lecture media use, was found to be the smallest group (14.4%). In contrast, the largest group (40%), aware-passive, perceived in-lecture media use to engender negative outcomes for students, but did not institute restrictive policies. Such a policy corresponds to the laissez-faire approach identified by Finn and Ledbetter (2013). Those classified as aware-active (18.4%), on the other hand, enacted policies discouraging in-lecture media use. Finally, those labelled as enthusiast-welcoming (27.2%) held favourable perceptions of in- lecture media use and, consequently, encouraged such behaviour.

While Finn and Ledbetter (2013) considered students' perceptions and Berger (2017) considered lecturers' attitudes, Santos, Bocheco and Habak (2018) compared student and lecturer perceptions of in-lecture media use and policies. Both lecturers and students regarded task-related media-use as appropriate in-lecture behaviour, and considered the outright restriction of media to not be of value. Although they acknowledged the value of task-related media use, lecturers tended to adopt strict policies prohibiting in-lecture media use. Despite such policies, and an awareness of media-related distractions, students reported frequently engaging in in-lecture media use for both task-related and unrelated activities.

As Berger (2017) indicates, there are a number of archetypal policies adopted by lecturers. Where media use is restricted, methods include: device confiscation, mark-deductions, verbal warnings, and incentives (Bowman, Levine, Waite and Gendron, 2010; Flanigan and Kiewra, 2017; Kuznekoff and Titsworth, 2013). However, as Tindell and Bohlander (2012) indicate, enforcement of such policies is often inconsistent and ineffective. While many lecturers fail to specify or enforce such policies, Ledbetter and Finn (2013) found that students expect a policy indicating appropriate behaviour with media and, in the absence of a clearly specified or enforced policy, presume that OTMU is appropriate. Confirming this, Tindell and Bohlander (2012) found that, in such instances, in-lecture OTMU increases.

2.3. Conclusions

A number of dominant trends are observable in the literature. There is consistent evidence that in-lecture OTMU

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

obstructs effective comprehension of covered content. While there is no conclusive evidence that this relationship is causal in nature, there is sufficient evidence to conclude that curbing in-lecture OTMU is desirable for promoting learning. Importantly, studies have emphasised that the negative effects of in-lecture OTMU are not limited to users, peers in close proximity to a user are also distracted by his/her media.

The reviewed studies suggest that the majority of lecturers adopt a passive stance to in-lecture OTMU among their students, avoiding the responsibility of explicitly policing this form of behaviour. Underlying this trend is the perspective that students, as adults, should take responsibility for and regulate their own behaviour in accordance with their academic performance goals. While lecturers who adopt this perspective may communicate policies forbidding in-lecture OTMU in a ceremonial manner in course frameworks or introductory lectures, they often fail to enact them.

Studies suggest that, while policies forbidding OTMU in lectures are not always adhered to or effectively enforced, the absence of such policies cultivates high levels of OTMU among students. In such scenarios the norms that guide media use in lectures are established in a bottom-up manner by students. However, stipulating and enforcing a policy which forbids in-lecture media use negates the potential value of constructively using media to engage students or enhance the learning experience. Between these two extremes are a number of policy options yet to be explored and tested.

3. Research Design

The present study reports the implementation of a media use policy adopted in a final-year course at a large, residential, research intensive university in South Africa[1]. The policy, which is outlined in more detail in the section hereafter, was developed with the aim of encouraging the self-regulation of in-lecture media use among students by allocating separate sections of the lecture theatre for students who wished to use electronic devices and those who wished not to. To assess this policy the following research objectives were formulated:

[1] The university is ranked inside the top 400 on the 2017/2018 Times Higher Education World University Rankings (Times Higher Education, 2017) and has a student population of 31 639.

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

- To establish how the policy was perceived by the students involved and which factors influenced this perception.

- To determine how the policy influenced students' media use behaviour during the course of the semester.

- To determine the effects of the policy on the students' academic performance and engagement with the course content.

To address these objectives a combination of quantitative and qualitative data was col- lected throughout and after completion of the course. The study can, therefore, be broadly described as a field quasi-experiment conducted to explore the feasibility of a proposed policy.

3.1. Setting

The following sections describe the setting in which the policy was implemented. The course outline is briefly described, followed by an overview of the media use policy, the physical environment within which it was applied and, finally, the participants in the course.

3.1.1. Course Outline

The course is offered as part of the final year of an undergraduate *Management Information Systems* (MIS) program. The subject matter concerned the management of *knowledge work, knowledge sharing and knowledge creation* (i.e., Knowledge Management) and ran from mid-July to mid-October 2017. It was presented by a single lecturer (author three) and involved 27 lectures over a 10-week period.

A student's final score for the course was calculated based on two categories of assessment: four assignments, which accounted for 40% (10% per assignment) of the final score, and two essays, which accounted for 30% of the final score each. The four assignments involved questions relating to different case studies covered in the lectures. The course was structured such that, in the weeks prior to an assignment, material necessary for completing the assignment were covered and, in the week following the assignment, the case itself was discussed. This enabled the style of the lecture to be participatory, involving input and discussion from students. While lecture attendance was not strictly

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

compulsory, it was strongly encouraged and the value of class attendance for performance in the assignments was emphasised.

3.1.2. Physical Environment

The course was presented in a traditional, theatre-style lecture hall containing 13 rows of five seats on either side. The capacity of this venue was 143 seats. These seats were arranged in two blocks of 65 on either side of a central aisle. The thirteen remaining seats make up an extra row at the back of the venue. While not utilised, the venue did offer computer facilities for the presenter, as well as a data projector. It also offered Wi-Fi access to the university network and the Internet.

3.1.3. Media Use Policy

The media use policy for the course divided the lecture theatre into two sections on either side of the central aisle. The left-hand side was designated the *non-device section* and required those sitting in it to abstain from the use of electronic devices during the lecture. The other side was designated the *device section* and the use of electronic devices was permitted but optional.

The policy was developed on the basis of the authors' experiences as lecturers, as well as the research reviewed in Section 2. As noted in a number of previous studies there is value in providing students with a clear policy for in-lecture media use (e.g., Finn and Ledbetter, 2013; Ledbetter and Finn, 2013). In the absence of a clear policy or the ineffective enforcement of a policy, perceptions of lecturer credibility decrease and instances of OTMU increase. Additionally, as Ledbetter and Finn (2013) found, explicitly forbidding in-lecture media use is seen by students as dis-empowering. The proposed policy aimed to empower students to leverage the value of media, if they so desire, while affording those who wish not to use media, or be disrupted by their peers' use of media, a degree of protection from distracting cues. Additionally, studies of BYOD policies indicated that such policies tend to require participants to select an option at the beginning of the semester and abide by that choice for the remainder of the semester (e.g., Bayless et al., 2013; Berger, 2017). In this case students were able to, at the beginning of each lecture, select on which side they wished to sit. The expectation was that this would promote repeated instances of deliberate decision making about device use and, as a result, raise students' awareness of their media use patterns.

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

The lecturer verbally explained the policy to the class during the introductory lecture and reminded students thereof at the commencement of the next six lectures. Throughout the semester the lecturer enforced the policy by verbally reprimanding students who used electronic devices while sitting on the non-device side of the theatre.

3.1.4. Participants

The course was followed by 67 final year undergraduate students (37 male) enrolled in programs of study from three faculties: Arts and Social Sciences (n = 20), Economics and Management Sciences (n = 30), and Science (n = 15)[2]. Programs included: Management Science (n = 22), Geo-Informatics (n = 14), Socio-Informatics (n = 8), Humanities (n = 6), General Commerce (n = 7) and others (n = 10). Of the 67 students 64.18% reported their first language to be English, 25.37% to be Afrikaans and 10.45% other African and European languages. The average grade for courses in the year of the study, prior to enrolling in this course, was 57.0% (SD = 7.9).[3]

3.2. Data Collection

To address the stated research objectives, we collected and analysed both quantitative and qualitative data. In the sections which follow each of the data sources and the techniques used to compile them are briefly outlined.

3.2.1. Lecture Attendance Data

Separate attendance registers were used for the two sections to track students' decisions over the duration of the course. With the exception of an identifier in the bottom right corner (either 'D' for device or 'ND' for non-device), there were no differences between these two registers, with both listing the student IDs and surnames of all students registered for the course. The lecturer in charge of the course ensured that each register was only completed by those on the appropriate side of the aisle.

3.2.2. Academic Performance Data

For the purpose of our analysis we collected five academic performance (AP) variables for each student. The first

[2] Two participants were international exchange students and were not assigned to a faculty or program.
[3] In the relevant grading system a grade of 50 is required to achieve a pass and a grade of 75 represents a distinction.

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

(AP_F) was the student's final score for the course; the second (AP_E) was the student's mean score across the two essays; the third (AP_A) was the student's mean score across the four assignments; the fourth (AP_P) was the student's mean score for courses prior to enrolling in this course; and the fifth (AP_S) was the student's mean score for other courses run concurrently to the course in-question. After combining the AP and lecture attendance data into a single set all personal identifiers were removed to protect the students' anonymity.

3.2.3. Focus Groups with Students

After completion of the course two focus groups were conducted with students from the class. To identify participants we placed all students into five categories on the basis of their decisions to sit in the device/non-device sections during the lectures they attended. The five categories were determined as follows:

- Device only (DO) included students who only sat in the device section during the lectures they attended.
- Device high (DH) included students who sat in the device section during at least 80% of the lectures they attended.
- Movers (M) included students who alternated between the sections, sitting in either one during less than 80% of the lectures they attended.
- Non-device high (NDH) included students who sat in the non-device section during at least 80% of the lectures they attended.
- Non-device only (NDO) included students who only sat in the device section during the lectures they attended.

We decided that any students that attended 70% or more of the classes presented during the semester were eligible to be invited to participate in the focus groups. Our reasoning was that students who attended fewer classes would be less able to provide meaningful feedback on the policy. 27 students satisfied this criterion (DO = 9; DH = 5; M = 2; NDH = 3; NDO = 8). We proceeded to invite 20 students to participate in the focus groups with the aim of achieving equal distribution across the five categories. 17 students accepted the invitation (DO = 6; DH = 2; M = 1; NDH = 2; NDO = 6).

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

Two focus groups, with eight (DO = 3; DH = 1; NDH = 1; NDO = 3) and nine (DO = 3; DH = 1; M = 1; NDH = 1; NDO = 3) participants respectively, were conducted. The focus groups were facilitated by two of the authors of this article who were known to the participants, but not involved in the particular course reported here. The facilitators followed a shared topic guide which covered key themes relating to students' perception of the policy, their enactment thereof, and the perceived effects of this on their learning experience. Each focus group had a duration of approximately 55-minutes and was audio recorded.

4. Data Analysis and Findings

The findings are presented in two sections. In Section 4.1 the attendance and academic performance data are analysed and, in Section 4.2, the outcomes of the focus group procedures are reported.

4.1. Quantitative Analysis

We briefly outline the findings of the quantitative analysis by considering lecture attendance, device/no-device proportions and how these indicators related to academic performance.

4.1.1. Attendance

Table 1 presents a summary of the attendance rates and academic performance variables across the five media use categories[4]. The sample sizes of the various groups are small, ranging from six to 19, limiting statistical inference power. However, it is instructive to note that the class attendance rate was higher for the non-device students (m = 72.3, SD = 21.2) than the device students (m = 63, SD = 19.3), and substantially higher than movers (m = 53.1, SD = 26.8). Across the 27 lectures the mean attendance rate was 65.7% (SD = 20.4). Lecture 26 was the least attended lecture at 29.85% of all enrolled students, while lecture nine was the most attended lecture at 89.55%. As with most courses class attendance varied based on a range of factors (e.g., public holidays, assessment dates, university events etc.) and there is a general downward trend towards the end of the semester.

On average 57.99% (SD = 7.94) of the students in attendance sat in the device section of the class. The proportion of

[4] In addition to the five media use categories (DO, DH, NDH, NDO, M), the table presents three more general categories (Device, No Device and Movers).

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

students choosing to sit in the device section ranged from 35% to 70% of those in attendance, while the no-device section ranged from 30% to 65%. These numbers are visualised in Figure 1.

Table 1: Attendance and academic performance for each of the media categories

Categories		**Attendance**		**AP_F**		**AP_E**		**AP_A**		**AP_P**		**AP_S**		
	***n*[b]**	***M***	**SD**	***M***	**SD**	***M***	**SD**	***M***	**SD**	***M***	**SD**	***M***	**SD**	**AP_D[a]**
Device	*37*	*63.6*	*19.3*	*64.7*	*8.5*	*79.3*	*6.0*	*66.2*	*6.7*	*59.1*	*8.3*	*59.1*	*11.1*	*5.6*
DO	*19*	*68.0*	*16.1*	*67.3*	*7.1*	*81.1*	*3.8*	*66.4*	*7.2*	*62.7*	*7.4*	*62.4*	*8.3*	*4.9*
DH	*28*	*58.8*	*21.2*	*62.0*	*8.9*	*77.4*	*7.2*	*66.1*	*6.2*	*55.0*	*7.4*	*55.6*	*12.6*	*6.4*
No Device	*21*	*72.3*	*21.2*	*65.1*	*7.7*	*79.9*	*7.3*	*65.0*	*6.3*	*59.2*	*8.3*	*59.2*	*8.9*	*5.9*
NDH	*6*	*79.0*	*15.1*	*65.3*	*3.8*	*81.7*	*1.7*	*65.3*	*7.2*	*57.3*	*6.8*	*58.0*	*6.9*	*7.3*
NDO	*15*	*69.6*	*22.6*	*65.0*	*8.7*	*79.2*	*8.4*	*64.8*	*6.0*	*59.9*	*8.7*	*59.7*	*9.9*	*5.7*
Movers	*9*	*53.1*	*26.8*	*58.1*	*14.9*	*77.7*	*6.8*	*60.0*	*11.5*	*50.2*	*9.2*	*49.4*	*14.2*	*8.7*
Average		**65.7**	**20.4**	**63.5**	**8.7**	**79.4**	**5.6**	**64.5**	**7.6**	**57.0**	**7.9**	**57.0**	**10.2**	**6.5**

[a] The difference between students'' performance in this course and their mean performance across courses completed simultaneously, calculated as $AP_F - AP_S$

[b:] N=67

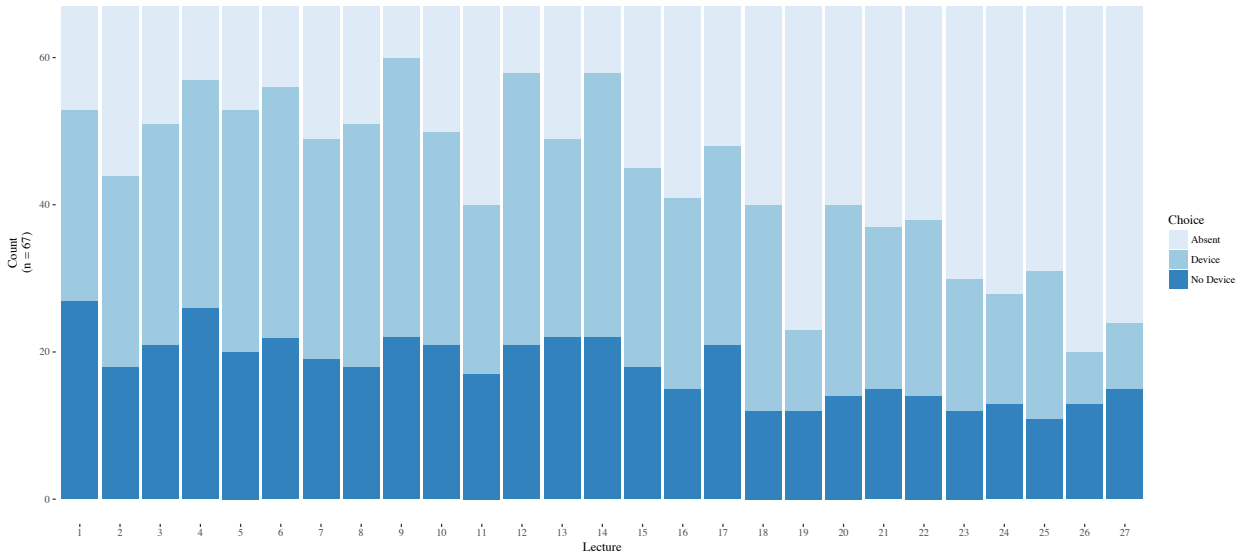

Figure 1: The proportion of students who attended each lecture, as well as the relative sizes of the device/no-device sections

4.1.2. Academic Performance

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

As can be seen in Table 1 the *device only* category had the highest mean final score (67.3). For prior scores the average score achieved by *movers* (50.2) was the lowest compared to *device* (59.1) and *no device* (59.2) categories. For courses conducted concurrently, the pattern is similar — the average is 6.5 percentage points higher in this course across all categories. Specifically, the largest difference was observed for *movers* (8.7). As with previous studies in this domain, we found a positive correlation between attendance rate and AP_F ($r = 0.12$, $p < 0.001$). However, device choice (calculated as the number of times the student sat in the device section as a proportion of the lectures attended) did not correlate significantly with AP_F. Moreover, a hierarchical linear regression indicated that device section did not provide additional explanatory power over AP_F.

4.2. Qualitative Analysis

The data produced during the two focus group sessions were transcribed and analysed using an inductive method of thematic analysis (Braun and Clarke, 2006). Directed by recurring elements in the data, a set of preliminary codes were produced and applied to the transcriptions. Through an iterative process of reading and re-reading, these codes were modified and augmented with additional codes. Following this, emergent patterns in the set of codes were collated into themes describing key aspects of the students' class experiences. To provide a degree of investigator triangulation, this process of coding and theme identification was conducted by two separate coders. Additionally, after coding, to ensure inter-rater reliability, cross checking of codes and peer debriefing procedures were conducted. To provide a data-grounded interpretative narrative of the students' experiences the themes are described in four sections presented as questions. Within each section the relevant theme is described, accompanied by a sample of associated supporting quotes from the focus groups.

4.2.1. How did students perceive the policy?

The majority of focus group participants felt that the policy presented a constructive means of managing the diverse media use preferences of the class. They felt empowered by being given the freedom to choose and enact their own media use strategy as opposed to being instructed or forced to follow a particular regiment. Participant 3 in Focus Group 1 (FG1P3) stated that:

It wasn't imposed on the people which side they must sit, they could decide, and I think that's why it was accepted.

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

Because people could say, 'Ok, I don't feel like using my device today'. It was free will.

FG2P5 agreed with this sentiment.

Because I had the option I didn't feel like not being allowed to go on my phone was a punishment or something that was a rule. It was my own free will. So, for me it was a way to encourage going to class. Because I felt like I was actually forcing myself not to go on my phone but it was my choice.

It was clear in the focus group discussions that few (if any) other lecturers that the participants were exposed to imposed explicit media use policies in their courses. Participants acknowledged that their behaviour, in such scenarios, is determined by the dominant norm, i.e., frequent in-lecture OTMU.

The other classes, [using your phone] is just the norm, so why should I make the decision in the first place there. (FG1P4)

Focus group participants valued the manner in which the non-device side offered them a degree of protection against distractions as a result of media use by their peers.

I also really liked the divide, because if you sit next to somebody that is permanently on their device, it is somewhat distracting and it was nice that on this side you can do whatever you want but on that side, you can sit and work. That is all you are there for. (FG1P5)

4.2.2. How did the policy influence students' attitudes about and behaviour with media?

A key feature of the policy is that, while it does not prescribe a particular form of media use, it forces students to choose whether they will have access to their devices during the lecture. This decision-making process encourages critical reflection about (or monitoring of) media use behaviour which is an important element of effective self-regulation. FG2P5 provided a description of how her reflection about media use influenced her seating decision:

In the first lecture, I happened to sit on the side that he designated as the non- device side and I am someone who is always on my phone every class. And then it kind of just stuck. So then the next class I sat on that side again and I realised, 'Ok, wait, maybe I should move'. But then I sat on that side and I kind of felt because I sat on that side it was

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

me making the decision not to go on my phone as opposed to the lecturer telling you that you can't.

Students that habitually used their laptops for note taking tended not to reflect about the policy, sitting on the device side of the class was an obvious and natural decision for them.

Most of us are [Informatics] students so we carry our laptops with us. So automatically I just go to the technology side. (FG2P1)

FG1P6 expressed a similar view.

Well, usually I take notes on my laptop, so then I just chose the device side.

While students did use their devices for academic purposes, participants who chose the device section admitted that they often engaged in OTMU when they became bored or disengaged by the lecture.

If it's like a conversation, like a debate between two people, then I was, like, this is not interesting and just [engage in OTMU]. (FG1P7)

One of her peers agreed:

If we would discuss the workshops that we just did I was just, like, I don't want to listen to this right now then I would sit on the device side and mess around. (FG1P2)

FG2P6 explained that he often has multiple tabs opened on his device and switches between academic and non-academic activities during the lecture.

I generally do both. So sometimes I will have a tab open with the slides, the PDF textbook and then probably Reddit if that's what I have decided to go on.

An interesting effect of the policy was that it heightened students' awareness of the manner in which their media use may be a distraction to those around them. FG1P1 explained:

At first, I sat on the non-device side, but then I moved over to the device side because I found that then I could take down notes more easily on the laptop. But I still sat at the back of the class, because I still felt like I was going to be

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

a distraction because not everyone on the device side uses a device.

4.2.3. How did the policy influence students' engagement with course content?

When considering students' perceptions of the policy and in-lecture engagement, an initial theme emerging was the influence of the policy on concentration and perceptions of the ability to focus on course content without any media-related distractions. FG1P4, for instance, stated that:

I thought it was good, because the moment you walk into the class you know 'OK, my phone is going to be in my pocket for the rest of this class and I am going to be able to just focus on the class'.

Similarly, describing the influences of the policy on concentration, FG2P9 termed his choice the 'winning formula':

I had a 100% track record on the non-device side. I kinda told myself that it was the winning formula. I told myself non-device you can focus more and you remember what he says. For me it just stuck. I didn't have any distractions in front of me. It just worked. I thought about going to the device side once or twice. I thought that is just not the winning formula.

An interesting dimension raised during the focus groups was the effect of the policy on the manner in which students engaged with and reflected critically on discussions within the lectures. While a device enabled students to easily access online resources, definitions or further information on a topic, participants indicated that this effected how they processed and considered topics. Looking up a definition or concept was seen to force a rigid manner of thinking while, in contrast, those on the non-device side relied on personal intuition or creativity to participate in the discussions. Participants considered this to be challenging but, ultimately, positive for their engagement with and understanding of the course material. For instance, FG1P6 stated that:

On the device side, if he asked for a definition like what is knowledge or information? I would just look it up, like easily. But, the non-device side was more challenging to try to figure out what he wants to hear. So, you had to be creative and not just look up a straight definition.

FG1P5 agreed with this sentiment:

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

I want to agree with him on the more challenging. The non-device side challenges you. Because you sit and have no extra resources to get the knowledge. So you have to listen to everybody else, you have to listen to [the lecturer] and formulate an opinion.

In contrast to producing a rigid understanding of a topic, some focus group participants considered the ability to consult online resources as an important factor which facilitated participation and processes of knowledge creation. For instance, FG2P8 stated that:

When I sit in class and I can be on my device and actually read up or like look up what he is talking about, I feel more engaged. Because then I have more content, more information. Then I can actually contribute to the discussion.

When considering how the policy influenced their in-lecture attentional strategies a num- ber of participants noted that they have, over the course of their university careers, formed attention allocation strategies for lectures. While acknowledging the value of separating device users from the rest of the class, the focus group participants felt that applying such a policy in a final year course was too late to influence their attentional strategies. For instance, FG1P4 noted that:

I found what works for me in the two years. Like, if somebody introduced the concept to me when I came in first year it would have, obviously, streamlined a change and you would have found the change down the line. It couldn't really change much now.

4.2.4. What were the negative effects of or limitations introduced by the policy?

While, generally, the participants regarded the policy positively, they identified a number of limitations and negative effects. A prominent negative effect arising from the policy was the unintended endorsement of OTMU in the lecture. While the policy was intended to enable those who wish to leverage the value of media in a lecture to do so without presenting a distraction to those who wish to participate in a lecture without such devices, students understood the policy as a license to use media for any purpose. For instance, FG1P2 stated that:

If I get distracted, I wouldn't feel guilty about going on my phone because I knew I was on the right side of the class and I wouldn't be distracting anybody else.

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

Similarly, FG1P5 commented that:

You don't feel guilty at any point so I really like that part of the split.

Another negative effect of the policy was the anxiety and distraction arising from the temporary separation from a device. For instance, FG1P3 noted that, while on the non-device side, the inability to check incoming messages presented as a distraction.

Sometimes I was sitting on the non-device side and a message would come through but you instantly know, I mustn't check it now because I am sitting on this side and then, in a sense, it would distract us. I felt that that could have been distracting in moments, at times where we knew there was something there but, at the back of the mind, it was distracting us from the lecture.

5. Discussion

The outcomes of this exploratory assessment provide a number of interesting contributions to research concerning the application and enactment of BYOD policies. While the sample sizes of the five media use categories are too small to justify strong assertions on the basis of our quantitative analysis, a number of interpretations of the behavioural patterns, supported by the qualitative data, are provided. To follow, we briefly discuss these outcomes, highlighting key limitations in this study and directions for future research.

Confirming Katz and Lambert (2016), attendance was shown to relate positively with academic performance. However, in addition to attendance, the data suggest that students who opted to sit in the same section of the class at least 80% of the times they attended, performed better than those who moved between the two sections. Considering this finding in relation to the qualitative data we propose that better academic performance is associated with clear, pre-defined in-lecture media use strategies. Students that develop such strategies come to class with well-developed ideas about what, for them, constitutes optimal, productive in-lecture media use and enact these strategies habitually. This finding extends Rosen et al. (2011)'s discussion of the relation between media use strategies and learning outcomes. We believe that movers, in contrast, approach lectures without clearly defined goals or media use strategies and, as a result, adapt their behaviour based on dynamic factors like emotional state or short-term needs. This hampers the development of personal behavioural standards and leads to ineffective self-regulation (Wu, 2017). Focus group

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

discussions suggested that students develop in-lecture behavioural strategies during the early parts of their university careers and that intervening in the third or fourth year of study may be too late to promote productive in-lecture behaviour. We suggest, accordingly, the implementation of this policy would be more beneficial in first-year courses.

While the quantitative data does not provide evidence that the use of in-lecture media either improves or impairs academic performance, we believe that our findings should be interpreted within a more holistic appreciation of the course outcomes. In particular, we believe emphasis should be placed on the manner in which students in the non-device section were encouraged to engage in critical thinking and deductive reasoning during the lectures. Much of the literature on in-lecture media use highlights the manner in which ubiquitous access to information hampers students' motivation and ability to engage in these higher- order activities (Waite et al., 2018). In the course analysed in this study it created a degree of tension between the two sections as those on the non-device side felt that, during debates, they were at a disadvantage due to not having access to the Internet. The management of this tension presents a challenge to the policy's implementation as lecturers should strive to also encourage critical thinking among device users as opposed to allowing them to merely look up and regurgitate content from, for example, *Wikipedia*.

Our study uncovered a number of challenges and/or limitations to the implementation of the policy. The first is that the policy obviously limits the degree to which devices can be used constructively during lectures. The lecturer may, for example, wish to have students complete an activity which involves using the Internet. The second is that students sitting in the non-device section of the class may experience a degree of anxiety due to their separation from their devices. Such anxiety may not only be distracting in itself, but may also lead to negative affect which, in turn, may negatively affect attentiveness and concentration (Gaudreau et al., 2014). We believe that such anxiety may subside as students become accustomed to being device-free in lectures, but we suggest that future research test this proposition. A third factor is the impact of subject area on the policy's applicability. We acknowledge that the cross-subject feasibility of the policy is not guaranteed and suggest that potential adopters consider adaptations and refinements based on the nature of their academic offering. Finally, we acknowledge that the implementation of the policy depends on the physical environment in which lectures are presented. Not all lecture theatres enable a left-right split and, when considering alternative arrangements, care should be taken to ensure that the two sections (device and non-device) are designated such that students are not disadvantaged in any way. For example, by designating the front half of the class as non- device section, students with devices may be less able to engage the lecturer or participate in

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

debates due to their positioning in the back. Moreover, in classes where the theatre matches class size and spare seating is not available, a left-right split would require 50-50 device vs. non-device distribution. Such a distribution is unlikely and lecturers would need to devise an appropriate arrangement to cater for the scenario.

In addition to limitations arising from the policy in question, a number of limitations resulting from the study design merit consideration. First, while the use of focus groups provided interesting insights into the enactment and effects of the policy, it did not enable the isolation of an effect in the manner a pre-post experiment would. Similarly, while the focus group discussions indicated an effect on learning outcomes such as class engagement and participation, not assessing such outcomes in a quantitative manner limited the extent to which such effects could be considered. In a related manner, without measuring whether participants actually used their devices when in the device section, isolating this behaviour is problematic. Consequently, in addition to performance-related outcomes, future studies should endeavour to assess actual device use and other, higher-order learning outcomes. Additionally, as noted previously, while the quantitative outcomes point to interesting patterns, as a result of the limited sample size, the extent to which statistical inference can be made is limited. Therefore, in future research assessing such a policy, a sample size more adequately powered to infer an effect is required. Finally, while the sample employed in this study is representative of MIS students, the extent to which outcomes assessed on such a sample would generalise to the broader population of university students remains unknown.

6. Conclusion

In conclusion, we believe that the proposed policy, despite limitations identified in this study, is a potentially feasible mechanism for the management of in-lecture media use among university students. We believe that it may be particularly valuable as a means to cultivate active participation and engagement in classes, as well as critical and creative thinking skills. Moreover, we see it as a means to create awareness among students of their own in-lecture media use behaviours and encourage them to critically evaluate the effects of these behaviours on their learning.

Finally, we propose that the policy we outline be considered as a general template and we encourage adopters to adapt it to ensure that it aligns with the nature of their offering and learning outcomes. Such adaptations should not be limited to the policy's formulation, the implementation itself can be flexible to enable, for example, the constructive use of devices in particular lecturers or parts thereof.

1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
* Douglas A. Parry: dougaparry@sun.ac.za

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* Douglas A. Parry: dougaparry@sun.ac.za

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* Douglas A. Parry: dougaparry@sun.ac.za

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1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa
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1. Department of Information Science, Stellenbosch University, Stellenbosch, South Africa

* Douglas A. Parry: dougaparry@sun.ac.za