Labour Economics xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Labour Economics

journal homepage: www.elsevier.com/locate/labeco

Ill Communication: Technology, distraction & student performance

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HIGHLIGHTS

- We investigate the impact of schools banning mobile phones on student test scores.
- We implement a difference in differences (DID) strategy.
- We combine a survey of school policies and England's National Pupil Database.
- There is an increase in student performance after schools bans mobile phones.
- These effects are driven by the previously lowest-achieving students.

ARTICLE INFO

Article history:
Received 18 August 2015
Received in revised form 7 April 2016
Accepted 10 April 2016
Available online xxxx

JEL classification:
I21
I28
033
J24

Keywords:
Mobile phones
Technology
Student performance
Productivity

ABSTRACT

This paper investigates the impact of schools banning mobile phones on student test scores. By surveying schools in four English cities regarding their mobile phone policies and combining it with administrative data, we adopt a difference in differences (DID) strategy, exploiting variations in schools' autonomous decisions to ban these devices, conditioning on a range of student characteristics and prior achievement. We find that student performance in high stakes exams significantly increases post ban, by about 0.07 standard deviations on average. These increases in performance are driven by the lowest-achieving students. This suggests that the unstructured presence of phones has detrimental effects on certain students and restricting their use can be a low-cost policy to reduce educational inequalities.

1. Introduction

Technological advancements are commonly viewed as leading to increased productivity. Numerous studies document the benefits of technology on productivity in the workplace and on human capital accumulation.[1] There are, however, potential drawbacks to new technologies, as they may provide distractions and reduce productivity. Mobile phones can be a source of great disruption in workplaces and classrooms, as they provide individuals with access to texting, games, social media and the Internet. Given these features, mobile phones have the potential to reduce the attention students pay to classes and can therefore be detrimental to learning.

There are debates in many countries as to how schools should address the issue of mobile phones. Some advocate for a complete ban while others promote the use of mobile phones as a teaching tool in classrooms. This debate has most recently been seen with the Mayor of New York removing a ten year ban of phones on school premises in March 2015, stating that abolition has the potential to reduce inequality (Sandoval et al., 2015).[2] Despite the extensive use of mobile phones by students and the heated debate over how to treat them, the impact of mobile phones on secondary school student performance has not yet been academically studied.

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[1] E.g.: Kruger, 1993; Chakraborty and Kazarosian, 1999; Aral et al., 2007; Ding et al., 2009; and Malamud and Pop-Eleches, 2011.

[2] Other examples of the debate are: Telegraph 2012; Childs, 2013; Barkham and Moss, 2012; Drury, 2012; O'Toole, 2011; Johnson, 2012; and Carroll, 2013.

http://dx.doi.org/10.1016/j.labeco.2016.04.004
0927-5371/

In this paper, we estimate the effect of schools banning mobile phones on student test scores. This differs from other technology in schools research in that it examines the removal of an unstructured piece of technology, rather than a technology introduction. The lack of consensus regarding the impact of mobile phones means that there is no UK government policy about their use in schools. This has resulted in schools having complete autonomy on their mobile phone policy, and so have differed in their approaches. We exploit these differences through a difference in differences (DID) estimation strategy. We compare the gains in test scores across and within schools before and after mobile phone bans are introduced, where previously there was no stated policy.[3]

In order to do this, we generated a unique dataset on the history of mobile phone and other school policies from a survey of high schools in four English cities (Birmingham, London, Leicester and Manchester), carried out in spring of 2013. This is combined with administrative data on the complete student population from the National Pupil Database (NPD). From this, we know the academic performance of all students since 2001, and so use differences in implementation dates of mobile phone bans to measure their impact on student performance. Moreover, the NPD tracks students over time, which allows us to account for prior test scores along with a set of pupil characteristics including gender, race, ever eligible for free school meals (FSM), and special educational needs (SEN) status. Although we do not know which individuals owned mobile phones, it is reported that over 90% of teenagers owned a mobile phone during this period in England; therefore, any ban is likely to affect the vast majority of students (Ofcom, 2006, 2011).[4] Even if a student does not own a phone themselves their presence in the classroom may cause distraction.

We find that following a ban on phone use, student test scores improve by 6.41% of a standard deviation. This effect is driven by the most disadvantaged and underachieving pupils. Students in the lowest quintile of prior achievement gain 14.23% of a standard deviation, while, students in the top quintile are neither positively nor negatively affected by a phone ban. The results suggest that low-achieving students have lower levels of self-control and are more likely to be distracted by the presence of mobile phones, while high achievers can focus in the classroom regardless of the mobile phone policy. This also implies that any negative externalities from phone use do not impact on the high achieving students. Schools could significantly reduce the education achievement gap by prohibiting mobile phone use in schools. We find the impact of banning phones for these students equivalent to an additional hour a week in school (Lavy, 2016), or to increasing the school year by five days (Hansen, 2011). We include several robustness checks such as event studies, placebo bans, tests for changes in student intake and a range of alternative outcome measures.

The rest of the paper is organized as follows: Section 2 discusses the related literature; Section 3 provides a description of the data, survey and descriptive statistics; Section 4 presents the empirical strategy; Section 5 is devoted to the main results and heterogeneity of the impacts; Section 6 provides a series of robustness checks; and Section 7 concludes with policy implications.

2. Related literature

Our paper is related to the literature on technology used on student outcomes. There is a growing literature on the impact of technology on student outcomes, which has yet to reach a consensus. Fairlie and Robinson (2013) conduct a large field experiment in the US that randomly provides free home computers to students. Although computer ownership and use increase substantially, they find no effects on any educational outcomes. Similar findings have occurred in recent randomized control trials (RCTs) in developing countries where computers have been introduced into the school environment (Barrera-Osorio and Linden, 2009; Cristia et al., 2012).

Some studies have found a positive impact from technology, such as Machin et al. (2007), who estimate the impact of information and communication technology (ICT) investment on student outcomes in England, using changes in funding rules as an exogenous shock to investment. They find that ICT investment has a positive effect on student test scores in English and science, but not for mathematics (where computers were rarely used). Barrow et al. (2009) examine the impact of structured computer aided instruction using a RCT design in three large urban school districts. They find that this maths software had large impacts on students algebra test scores (0.17 of a standard deviation).

Specifically relating to mobile phones, Bergman (2012), as part of an RCT, used mobile phones to inform parents of students' homework assignments through texting. The students of parents who were sent messages achieved higher test scores. Fryer (2013) provided free mobile phones to students in Oklahoma City Public Schools in a field experiment. Students received daily information on the link between human capital and future outcomes via text. There were no measureable changes in attendance, behavioral incidents, or test scores.[5]

The common theme in these education papers is that the mere introduction of technology has a negligible impact on student test scores, but when incorporated into the curriculum and being put to a well-defined use, technology has the potential to improve student outcomes. Oppositely to those papers, we are not looking at the introduction of technology, but the removal of un-structured presence on student outcomes.

The psychological literature finds that multitasking is detrimental to learning and task execution in experimental contexts. Many recent experimental papers present evidence that mobile phone use while executing another task decreases learning and task completion (e.g. Ophir et al., 2009; Smith et al., 2011; Levine et al., 2013; Kuznekoff and Titsworth, 2013; Dietz and Henrich, 2014). The distracting nature of mobile phones has been previously examined in other context such as incidence of road accidents. Bhargava and Pathania (2013) exploit a pricing discontinuity in call plans and show that there is a large jump in phone use after 9 p.m. This jump, however, is not followed by an increase in car accidents. Using vehicular fatality data from across the United States and standard difference in differences techniques, Abouk and Adams (2013) find that texting bans have only a temporary impact on car accident fatalities, suggesting that drivers react to the announcement of a legislation only to return to old habits shortly afterward.

Finally, our paper is closely related to the literature on student effort and distraction in the classroom. These distractions can occur from a variety of events. By example, Metcalfe et al. (2011) find, using the same UK dataset, that the timing of world cup soccer matches impacts students' exam performance. Beland and Kim (2016) find that student performance decreases following a school shooting.[6] Our paper differs in that these are rare events, whereas the presence of phones can be an everyday occurrence.

Our contribution to the literature is to estimate the effect of mobile phone bans on high stakes student test scores at the end of compulsory

[3] We argue that schools differ in years of implementation based on their reaction to phones becoming popular among students. This effect could potentially be an upper bound on the impact of banning mobile phones as the variation that we are exploiting is the introduction of bans among schools that expect to gain from this policy.

[4] We further discuss phone ownership rates in Section 3. The focus of this paper is the impact of a school level policy which may have impact on students who own a phone, but also on students who don't own a phone but could still be distracted through the actions of others.

[5] However, Fryer (2013) does find that students' reported beliefs about the relationship between education and outcomes were influenced by treatment, and treated students also report being more focused and working harder in school.

[6] See also Stinebrickner and Stinebrickner (2008); and De Fraja et al. (2010) for other examples of how events can affect student effort and distractions and lead to lower student performance.

Please cite this article as: Beland, L.-P., Murphy, R., Ill Communication: Technology, distraction & student performance, Labour Econ. (2016), http://dx.doi.org/10.1016/j.labeco.2016.04.004